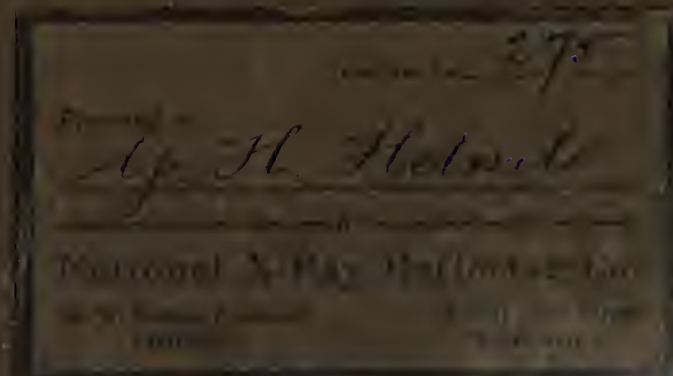


ILLUMINATION *from* CONCEALED SOURCES

Planning Interior Lighting



*Planning and
Specifying
Interior
Lighting*



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TO THOSE ARCHITECTS AND ENGINEERS WHOSE VALUABLE CO-OPERATION HAS ASSISTED US
IN DEVELOPING CORRECT METHODS AND APPLI-
ANCES FOR ECONOMICAL ILLUMINATION FROM
CONCEALED SOURCES, WE EXPRESS OUR SINCERE
APPRECIATION.

Augustus D. Curtis
Pres.

NATIONAL X-RAY REFLECTOR CO.



Boys High School
New Orleans, La.
E. A. Christy Architect

**Illumination *from* Concealed
Sources
and Detail Plates**

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NATIONAL X-RAY REFLECTOR CO.
NEW YORK CHICAGO

Illumination from Concealed Sources

Planning and Specifying Interior Lighting

Engineering Department—National X-Ray Reflector Company

HARVEY B. WHEELER, Chief Engineer

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THE EYE COMFORT LIGHTING SYSTEM

Indirect lighting, as exemplified by the EYE COMFORT LIGHTING SYSTEM, is essentially illumination from *concealed sources*. The light flux from the primary light source, the lamp, is directed to the ceiling, a relatively large area of which in turn reflects it back into the room, and in this capacity acts as a secondary light source.

The resultant illumination is characterized by *absence of high brilliancy light sources*, great *uniformity* of illumination, and excellent *diffusion* which *eliminates sharp shadows and specular reflection or glare* from glossy surfaces.

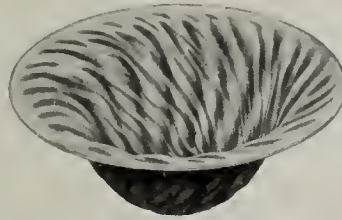
No other form of illumination adds so greatly to the comfort of the individual when working under artificial light. The uniform and diffuse illumination is very restful to the eye, and several hours' work under it causes practically no fatigue.

No other form of illumination is a better paying investment to the employer. The employee is able to work more expeditiously, he makes fewer mistakes, and since he is working under hygienic conditions his services and good will are retained. All of these considerations result in maximum human efficiency, which in these days of high wages, is just as important as machine efficiency.

No other form of illumination adds so greatly to the artistic appearance of an interior. It brings out the architectural features as a harmonious whole, most beautifully. Many modes of treatment make possible the design of lighting equipment, which will blend in with the architecture of the interior, and frequently be a part of it.

Scientifically designed X-RAY EYE COMFORT reflectors and accessories have been developed to meet the requirements for indirect illumination from ceiling fixtures of many types, floor pedestals, urns, portable floor and table art lamps, wall and pillar brackets, pillar capitals, corbels and cornices. This equipment has been standardized, and complete data, dimensional drawings, and other requisite information on the various types of reflector equipment is given herein.

With this data at his command, the architect or the illuminating engineer, can design his own fixtures to harmonize with the specific interior, and *be assured that the illumination will be ample in quantity,* perfect in quality*, and the combined artistic and lighting effect entirely in accord with the general period or scheme of decoration.



X-Ray Eye Comfort, One Piece
Silvered Glass Reflector



Tungsten Lamps

Equipment

Lamps

Tungsten lamps are rated in watts, and can be obtained in sizes varying from 10 to 500 watts. Most sizes can be supplied in

either straight or round bulbs. In sizes up to and including 60 watts, the lamps are furnished with unskirted bases, and above 60 watts with skirted bases.

The various sizes of tungsten lamps illustrated range from 40-500 watts inclusive. It will be noted that all sizes of lamps from 250 watts down, have Medium Screw bases, whereas the 400 and 500 watt sizes have Mogul bases. *With indirect lighting clear bulb lamps only should be used.*

Reflectors

The X-RAY reflector is the result of years of scientific research and investigation. It is a silvered glass reflector, which has a reflecting efficiency greatly in excess of any of the other commercial reflectors, and which gives perfect light control. The special process of silvering the outside of the one-piece tough blown glass form, assures thorough protection of the reflecting surface—pure silver—and results in permanency of reflecting efficiency.

X-RAY EYE COMFORT reflectors for indirect lighting are designed in two general types, distributing and concentrating, for tungsten lamps ranging in size from 15 to 500 watts. Table 1 gives complete data on all X-RAY EYE COMFORT reflectors.

Distributing reflectors are largely used where a considerable spread of light is required, in interiors having comparatively low ceilings. Concentrating reflectors are used mostly in interiors having high ceilings, where greater light concentration is required, such as churches, auditoriums and most large interiors.

*All data herein provides for ample indirect illumination without the need of any additional local illumination from desk lamps, etc.

EQUIPMENT

(Continued)

Fixtures

Luminous Bowls (See Plate 14)

It is good practice in many interiors, particularly restaurants, the main floor of stores (See Plate No. 8) and residences to softly illuminate part or all of the fixture. Plate No. 14 (see opposite page) gives complete data for designing "Luminous Bowls."

The indirect "Luminous Bowl" shown below consists of a metal rim, supporting a glass bowl and a multi-unit interior with lamps and reflectors in a horizontal position.



Luminous Bowl, Showing Interior Equipment

These lamps, in opaque X-RAY EYE COMFORT reflectors, give the useful indirect light.



This small lamp very softly illuminates the glass bowl for decorative effect only.

Opaque Bowls (See Plate 15)

In many interiors it is preferable to employ opaque bowls. This is particularly true of churches, where the best effects are obtained by making the lighting fixtures as inconspicuous as possible.

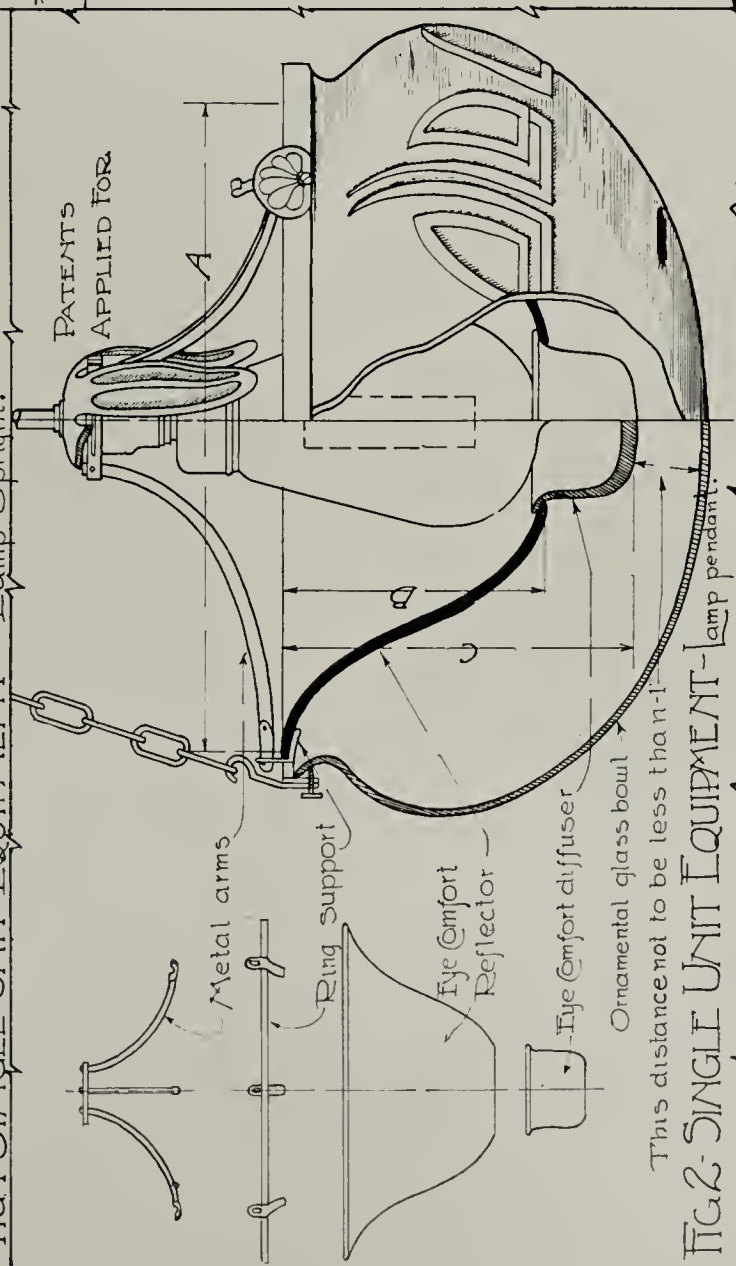
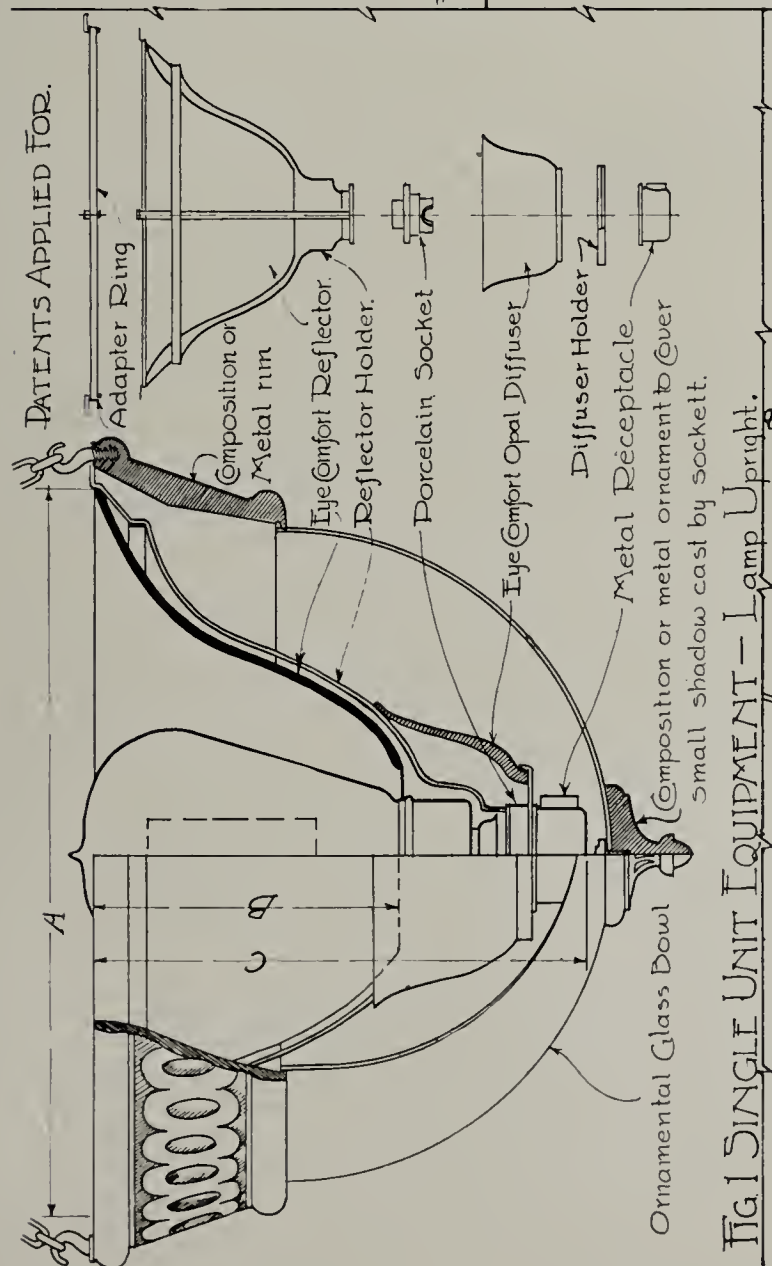
Various types of opaque totally indirect fixtures made of Compone* are illustrated on page 10 and complete data on the interior equipment is given on Plate No. 15.

Multi-unit shallow bowl indirect fixtures are used in rooms having ceilings from 9 to 12 feet in height; whereas deep bowl fixtures are used on ceilings exceeding 12 feet.

*Compone is a material which is not only durable, but which may be cast in artistic forms. Its surface is extremely tough and will take a variety of beautiful finishes impossible of application on the ordinary composition.

Table 1. Classification of X-Ray Eye Comfort Reflectors according to Light Distribution and wattage of lamps.

Reflector			Type of Reflector		Lamp		
No.	Dimensions		Light Distribution	Position of Lamp	Watts	Bulb	
	Diam.	Depth.				No.	Base
E-15	4 1/8"	1 13/16"	Concentrating	Vertical	15	G-18 1/2	Unskirted
E-15	4 1/8"	1 13/16"	"	"	25	G-18 1/2	"
E-40	6 1/2"	2 9/16"	"	"	25	S-19	"
E-40	6 1/2"	2 9/16"	"	"	40	S-19	"
E-40	6 1/2"	2 9/16"	"	"	60	S-21	"
E-60	-	2 13/16"	Distributing	Horizontal	25	S-19	"
E-60	-	2 13/16"	"	"	40	S-19	"
E-60	-	2 13/16"	"	"	60	S-21	"
E-100	9 1/2"	3 3/4"	"	Vertical	100	S-30	Skirted
E-200	9 1/2"	4 3/4"	Concentrating	"	100	S-30	"
E-200 1/2	9 1/2"	4 3/8"	"	"	150	S-35	"
E-150	12"	5 1/8"	Distributing	"	150	S-35	"
E-155	-	3 7/8"	"	Horizontal	100	S-30	"
E-155	-	3 7/8"	"	"	150	S-35	"
E-250	13 3/4"	5 1/2"	"	Vertical	250	S-40	"
E-255	13 3/4"	6 3/8"	Concentrating	"	250	S-40	"
E-255 1/2	13 3/4"	6 3/8"	"	"	400	G-56	"
E-500	16 5/8"	7 1/8"	Distributing	"	400	G-56	"
E-500	16 5/8"	7 1/8"	"	"	500	G-64	"



THE LUMINOUS BOWL PRINCIPLE.—Luminous Bowl EYE COMFORT Fixtures are truly indirect and are not to be confused with the so-called "Semi-indirect." Just as in the opaque indirect fixtures of metal and "Compo" each lamp is equipped with an opaque X-RAY EYE COMFORT REFLECTOR for the purpose of directing the light rays against the ceiling at the correct angle, thus insuring perfect indirect illumination. In this standard reflector equipment, provision is made for utilizing a small per cent of the light to illuminate very softly the glass bowl or panels in the fixture, (see illustrations above). With this method the bowl is not so glaring, nor harsh, nor obtrusive. Its faint glow casts no objectionable shadows. It does not ruin the beautiful indirect illumination which is so essentially an illumination from concealed sources. In short, luminous bowl EYE COMFORT fixtures possess artistically lighted bowls and do not sacrifice the indirect effect originally sought.

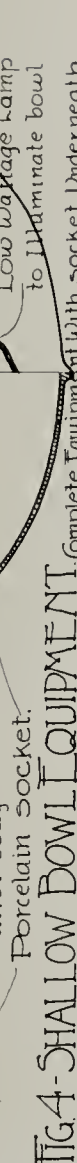
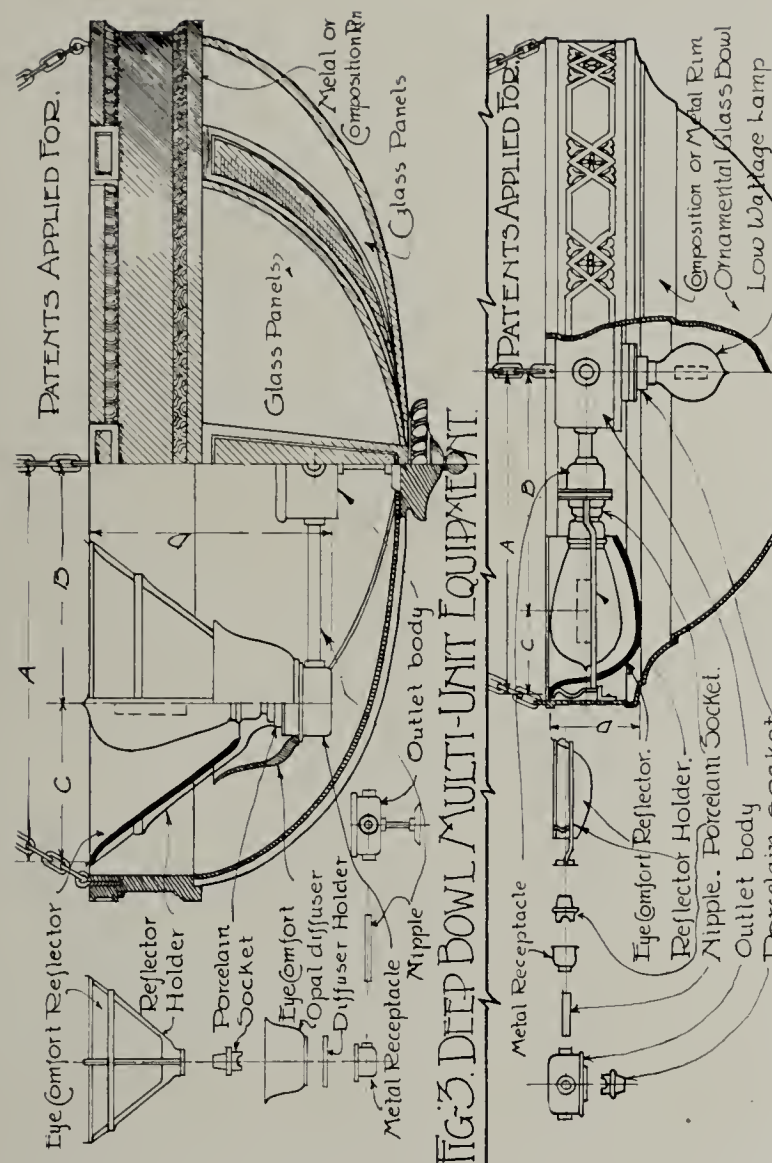


FIG. 1- SINGLE UNIT LAMP UPRIGHT.									
Catalog No.	Equipment		Dimensions in Ins.			Reflector - Lamps			
	A	B	C	D.		A	B	C	D.
8018A	E-100	100W	9 $\frac{3}{4}$	3 $\frac{3}{4}$	7 $\frac{1}{2}$	—	—	—	—
8019A	E-200	100W	9 $\frac{3}{4}$	4 $\frac{3}{8}$	7 $\frac{3}{4}$	—	—	—	—
8020A	E-200	150W	9 $\frac{3}{4}$	4 $\frac{3}{8}$	8 $\frac{5}{8}$	—	—	—	—
8021A	E-150	150W	12 $\frac{1}{2}$	5 $\frac{1}{2}$	8 $\frac{1}{2}$	—	—	—	—
8022A	E-250	250W	13 $\frac{3}{4}$	5 $\frac{3}{8}$	9 $\frac{1}{2}$	—	—	—	—
8023A	E-255	250W	13 $\frac{3}{4}$	6 $\frac{1}{2}$	9 $\frac{3}{8}$	—	—	—	—

FIG. 4. MULTI UNIT LAMPS HORIZONTAL									
7010A2	Light	E-60	-	60W	7"	-	3 $\frac{3}{8}$ "	2 $\frac{1}{2}$ "	"
7011A3	"	"	"	"	7 $\frac{1}{2}$ "	-	"	"	"
7012A4	"	"	"	"	9"	-	"	"	"
7013A5	"	"	"	"	10 $\frac{1}{2}$ "	6 $\frac{1}{2}$ "	"	"	"
7014A6	"	"	"	"	11 $\frac{1}{2}$ "	8 $\frac{1}{2}$ "	"	"	"
7015A7	"	"	"	"	11 $\frac{1}{2}$ "	8 $\frac{1}{2}$ "	"	"	"
7016A8	"	"	"	"	11 $\frac{1}{2}$ "	8"	"	"	"
7051A2	"	E-155	-	100 or 150W	9 $\frac{1}{2}$ "	-	3 $\frac{3}{8}$ "	3 $\frac{3}{8}$ "	"
7052A3	"	"	"	"	9 $\frac{1}{2}$ "	-	"	"	"
7053A4	"	"	"	"	11 $\frac{1}{2}$ "	-	"	"	"
7054A5	"	"	"	"	13 $\frac{1}{2}$ "	9 $\frac{1}{2}$ "	"	"	"
7055A6	"	"	"	"	13 $\frac{1}{2}$ "	9 $\frac{1}{2}$ "	"	"	"
7056A7	"	"	"	"	13 $\frac{1}{2}$ "	9 $\frac{1}{2}$ "	"	"	"
7057A8	"	"	"	"	15"	11"	"	"	"

7029A	5	13 1/8	8 5/8	..	..	..
7030A	6	14 3/8	9 3/8	..	..	..
7031A	7	16 1/8	11 3/8	..	..	..
7032A	8	17 3/8	12 3/8	..	..	..

EQUIPMENT

(Continued)

Specifications

NOTE:—The following is a sample specification for indirect lighting fixtures.

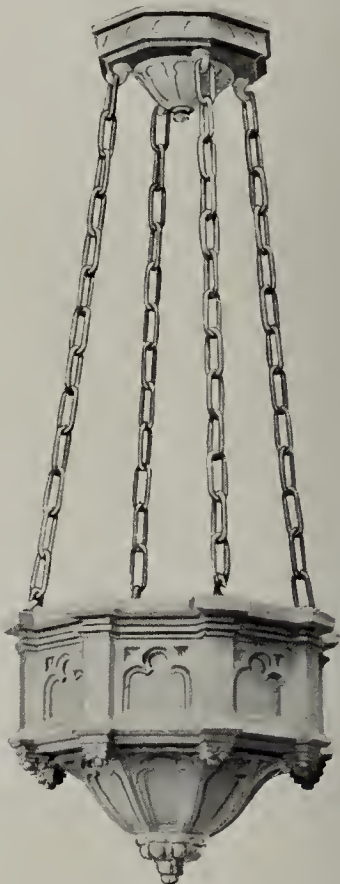
Fixtures.

All fixtures must be constructed of the material and finished as specified in the accompanying schedule of fixtures. Each fixture must be equipped with the type and number of X-RAY EYE COMFORT reflectors, and the standard interior equipment specified, and must be constructed in accordance with all rules and requirements of the National Board of Fire Underwriters.

Reflectors and Interior Equipment.

The reflectors to be furnished must be X-RAY EYE COMFORT of the types and sizes specified. The reflectors must be one-piece, tough blown silvered glass designed especially for indirect lighting, and for the type and size of lamps specified for each fixture.

The interior equipment consisting of reflectors, receptacles, holders, center bodies, nipples and all requisite accessories shall be the standard X-RAY EYE COMFORT interior equipment made expressly for the number and size of reflectors and lamps specified for each fixture, and which will hold the lamp and reflector in correct relation to each other.



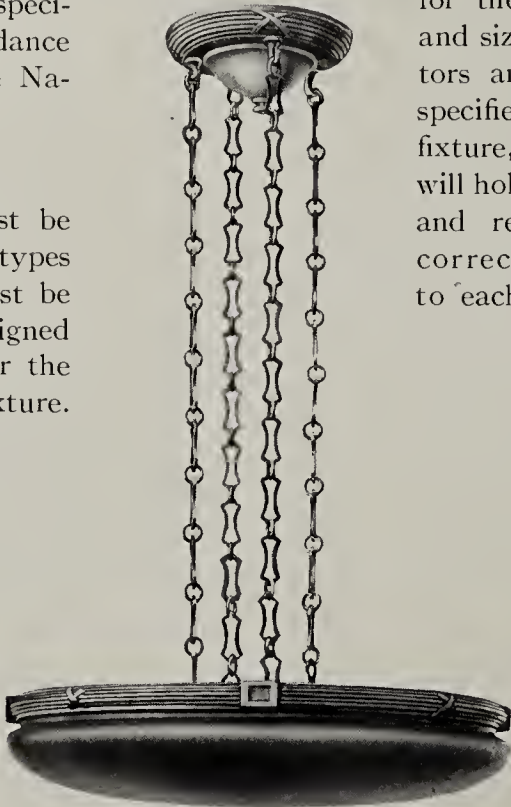
Single-Unit Deep Bowl



Single-Unit Deep Bowl Interior



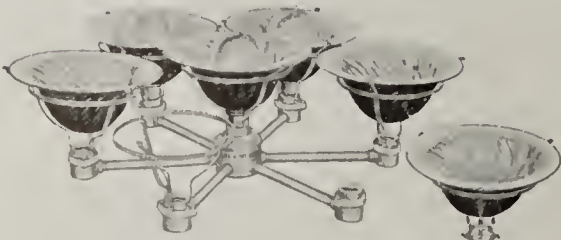
Multi-Unit Deep Bowl



Multi-Unit Shallow Bowl



Multi-Unit Shallow Bowl Interior



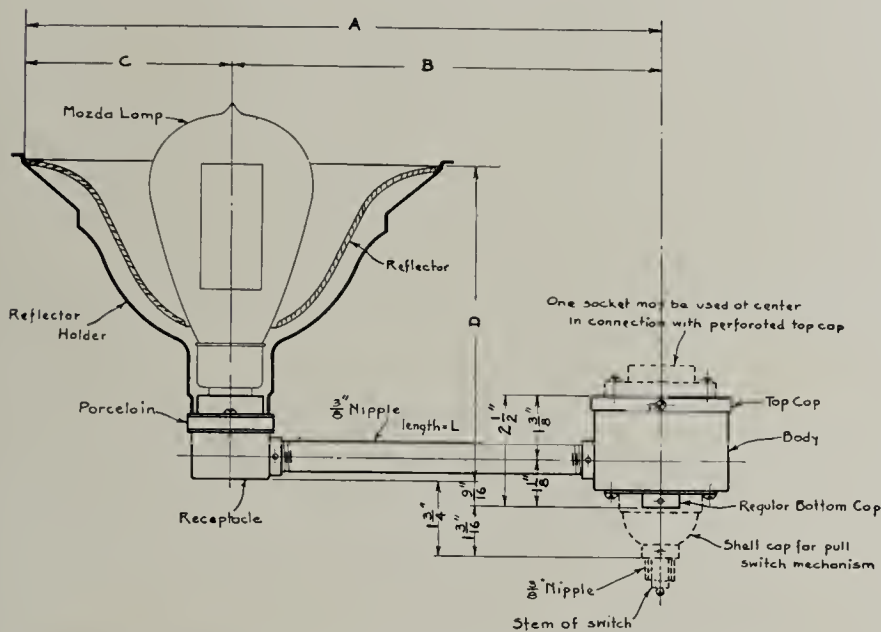
Multi-Unit Deep Bowl Interior

Schedule of Fixtures for Indirect Lighting

ROOM	Ceiling Height Feet	FIXTURE								
		No. Req'd.	Type No.	Material	Finish	LAMPS*		REFLECTOR		
						Per Fix-ture	Size Watts	Type No.	Interior Equip-ment No.	Length of sus-pension **
Private Office	12	1	643-F	Compone	Old Ivory	3	150	E-155	7052	36"
General Office	12	24	131-H	Brass	Bru'd Brass	1	250	E-250	8022	36"

*All lamps specified must be clear bulb tungsten having a voltage rating corresponding to the voltage of the circuit on which they are to be used.
**The length of suspension is the distance from the top of the reflector to the ceiling.

MULTI-UNIT INTERIORS DEEP-BOWL TYPE.

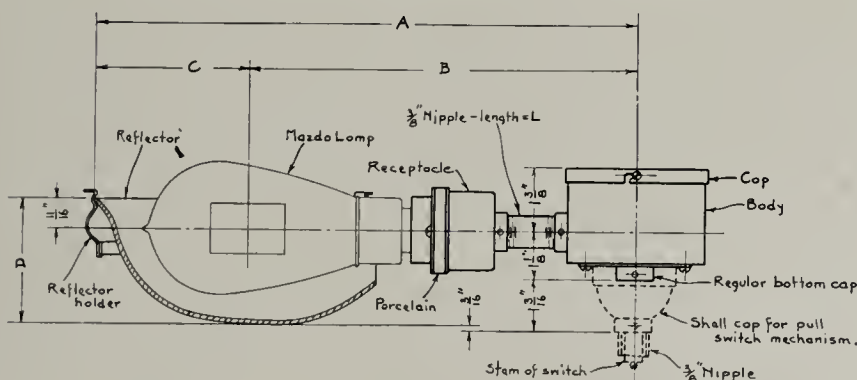


The general dimensions given on this sheet are intended primarily to indicate the minimum inside diameter and depth of fixtures in which these interiors are to be used. These interiors have been designed so as to keep the diameter a minimum, bent nipples being used on the 2, 3 and 4 light E-60 and the 2 and 3 light E-155 interiors to accomplish this.

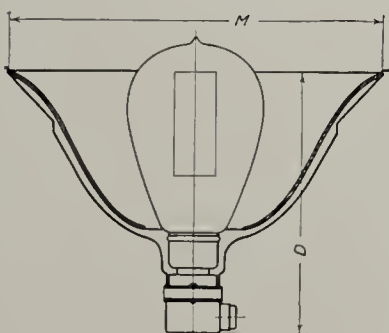
*Indicates that one socket may be used at center of body in connection with perforated top cap.

‡ For E-100 reflector $D=7\frac{3}{8}$; for E-200 $D=7\frac{3}{4}$;
† For E-250 reflector $D=9\frac{1}{8}$; for E-255 $D=9\frac{7}{8}$.

MULTI-UNIT INTERIORS SHALLOW-BOWL TYPE.



SINGLE-UNIT INTERIORS.



The dimension M indicates the minimum inside diameter of the fixture in which the unit is to be used. It is the overall length of the horizontal E-155 unit.

Catalog No	Equipment		Dimensions			
	Reflectors - Lamps		A	B	C	D
7000	2 light, E-40 refl	40w lamp	6 ⁵ / ₈	3 ³ / ₈	3 ⁴ / ₈	5 ³ / ₈
7001	3 " " " "	" "	7 ¹ / ₈	3 ⁷ / ₈	"	"
7002	4 " " " "	" "	8	4 ³ / ₄	"	"
7003	5 " " " "	" "	9 ¹ / ₈	5 ⁷ / ₈	"	"
7004	6 " " " "	" "	10	6 ³ / ₄	"	"
7005	7 " " " "	" "	11	7 ³ / ₄	"	"
7006	8 " " " "	" "	12 ¹ / ₈	8 ⁷ / ₈	"	"
7007	9 " " " "	" "	13 ¹ / ₈	9 ⁷ / ₈	"	"
7008	10 " " " "	" "	14 ¹ / ₈	10 ⁷ / ₈	"	"
7019	2 lt E-100 or E-200 refl	100w	9 ⁵ / ₈	4 ⁷ / ₈	4 ³ / ₄	†
7020	3 " " " "	" "	10 ³ / ₈	5 ⁵ / ₈	"	†
7021	4 " " " "	" "	11 ³ / ₄	7	"	†
7022	5 " " " "	" "	13 ¹ / ₈	8 ³ / ₈	"	†
7023	6 " " " "	" "	14 ⁵ / ₈	9 ⁷ / ₈	"	†
7024	7 " " " "	" "	16 ¹ / ₈	11 ³ / ₈	"	†
7025	8 " " " "	" "	17 ⁵ / ₈	12 ⁷ / ₈	"	†
7026	2 light E-200 1/2 refl	150w lamp	9 ⁵ / ₈	4 ⁷ / ₈	"	8 ⁵ / ₈
7027	3 " " " "	" "	10 ³ / ₈	5 ⁵ / ₈	"	"
7028	4 " " " "	" "	11 ³ / ₄	7	"	"
7029	5 " " " "	" "	13 ¹ / ₈	8 ³ / ₈	"	"
7030	6 " " " "	" "	14 ⁵ / ₈	9 ⁷ / ₈	"	"
7031	7 " " " "	" "	16 ¹ / ₈	11 ³ / ₈	"	"
7032	8 " " " "	" "	17 ⁵ / ₈	12 ⁷ / ₈	"	"
7034	3 light, E-150 refl	150w lamp	13	7	6	8 ¹ / ₄
7035	4 " " " "	" "	14 ³ / ₄	8 ³ / ₄	"	"
7036	5 " " " "	" "	16 ¹ / ₂	10 ¹ / ₂	"	"
7037	6 " " " "	" "	18 ¹ / ₄	12 ¹ / ₄	"	"
7038	7 " " " "	" "	20 ¹ / ₄	14 ¹ / ₄	"	"
7039	8 " " " "	" "	22 ¹ / ₈	16 ¹ / ₈	"	"
7040	9 " " " "	" "	24 ¹ / ₂	18 ¹ / ₂	"	"
7041	10 " " " "	" "	26 ¹ / ₄	20 ¹ / ₄	"	"
7045	3 lt E-250 or E-255 refl	250w	15	8 ¹ / ₈	6 ⁷ / ₈	†
7046	4 " " " "	" "	16 ³ / ₄	9 ⁷ / ₈	"	†
7047	5 " " " "	" "	18 ⁷ / ₈	12	"	†
7048	6 " " " "	" "	21	14 ¹ / ₈	"	†
7049	7 " " " "	" "	23 ¹ / ₈	16 ¹ / ₄	"	†
7050	8 " " " "	" "	25 ³ / ₈	18 ¹ / ₂	"	†
7059	3 light E-255 1/2 refl	400w lamp	15	8 ¹ / ₈	"	11
7060	4 " " " "	" "	17	10 ¹ / ₈	"	"
7061	5 " " " "	" "	19 ¹ / ₈	12 ¹ / ₄	"	"
7062	6 " " " "	" "	21	14 ¹ / ₈	"	"
7063	7 " " " "	" "	23 ¹ / ₈	16 ¹ / ₄	"	"
7064	8 " " " "	" "	25 ³ / ₈	18 ¹ / ₂	"	"
7066	3 lt E-500 refl	400 or 500 w	18 ⁵ / ₈	10 ¹ / ₈	8 ¹ / ₂	11 ³ / ₁₆
7067	4 " " " "	" "	20 ³ / ₄	12 ¹ / ₄	"	"
7068	5 " " " "	" "	23 ¹ / ₈	14 ⁵ / ₈	"	"
7069	6 " " " "	" "	26	17 ¹ / ₂	"	"
7070	7 " " " "	" "	28 ¹ / ₂	20	"	"
7071	8 " " " "	" "	31 ¹ / ₄	22 ³ / ₄	"	"

SHALLOW-BOWL EQUIPMENT.

7010	2 light E-60 refl	60w lamp	6 ⁷ / ₈	...	3 ³ / ₈	2 ¹³ / ₁₆
7011	3 " " " "	" "	7 ¹ / ₁₆	...	"	"
7012	4 " " " "	" "	8 ³ / ₈	...	"	"
7013	5 " " " "	" "	9 ⁵ / ₈	6 ¹ / ₄	"	"
7014	6 " " " "	" "	10 ⁵ / ₈	7 ¹ / ₄	"	"
7015	7 " " " "	" "	10 ⁵ / ₈	7 ¹ / ₄	"	"
7016	8 " " " "	" "	11 ¹ / ₂	8 ¹ / ₈	"	"
7051	2 lt E-155 refl	100 or 150w	9 ⁷ / ₁₆	...	4	3 ⁷ / ₈
7052	3 " " " "	" "	9 ⁵ / ₈	...	"	"
7053	4 " " " "	" "	11 ³ / ₄	7 ³ / ₄	"	"
7054	5 " " " "	" "	13 ³ / ₁₆	9 ³ / ₁₆	"	"
7055	6 " " " "	" "	13 ³ / ₁₆	9 ³ / ₁₆	"	"
7056	7 " " " "	" "	13 ³ / ₁₆	9 ³ / ₁₆	"	"
7057	8 " " " "	" "	14 ³ / ₁₆	10 ³ / ₁₆	"	"

SINGLE-UNIT EQUIPMENT. M D

8016	E-40 reflector	40watt lamp	6 ¹ / ₂	5 ³ / ₈
8112	E-155 " "	-100 or 150w lamp	11	3 ⁷ / ₈
8018	E-100 " "	-100watt lamp	9 ¹ / ₂	7 ³ / ₁₆
8019	E-200 " "	-100 " "	9 ¹ / ₂	7 ³ / ₄
8020	E-200 1/2 " "	-150 " "	9 ¹ / ₂	8 ⁵ / ₈
8021	E-150 " "	-150 " "	12	8 ¹ / ₄
8022	E-250 " "	-250 " "	13 ³ / ₄	9 ¹ / ₈
8023	E-255 " "	-250 " "	13 ³ / ₄	9 ⁷ / ₈
8110	E-255 1/2 " "	-400 " "	13 ³ / ₄	11
8111	E-500 " "	-400 or 500w lamp	17	11 ³ / ₁₆

CLASS A INSTALLATIONS

Included in this class are the following types of installations, in which *uniform* and *diffuse* general working illumination is required:

- Office Buildings

Hotels and Clubs

Barber Shop

Card Room

Sample Room
- Banks

Library Buildings

Stores and Display Rooms

Schools

Illumination Calculations.

(1) *Spacing and Number of Fixtures.*

Divide the area or bay to be illuminated into a number of equal rectangles, (approximate squares). For ceiling heights up to 12 feet, the maximum dimension of the rectangle should not exceed 1.5 times the ceiling height; from 12 feet to 17 feet inclusive, 1.75 times the ceiling height; above 18 feet, 2 times the ceiling height. Locate an electric ceiling outlet at the center of each rectangle.

(2) *Wattage Required.*

Select from the subsequent tables, the watts per square foot required for the particular interior. Multiply the area of one rectangle, obtained from (1), by this quantity, and obtain the required wattage per outlet or fixture.

(3) *Number of Lamps per Fixture.*

Knowing the watts per fixture and the wattage of the lamp it is desired to use, the number of lamps per fixture may be readily obtained.

(4) *Type of Reflector and Length of Suspension.*

Select from Table 2 the type of reflector (concentrat-

ing or distributing) and length of suspension required for the size of rectangle obtained from (1) and the ceiling height under consideration. Refer to Table 1 for the reflector number corresponding to the size of lamp to be used.

Example Calculation

It is required to illuminate a general office (Hibbard Spencer Bartlett & Co., Plate No. 1) of the following dimensions per bay.

Length 17' 0", Width 12' 4", Ceiling height 14' 6"

(1) *Spacing and Number of Fixtures.*

Multiply the ceiling height 14' 6" by 1.75 and obtain 25.4 feet, the maximum dimension of the rectangle that can be illuminated from one center outlet. Since the length of the bay does not exceed 25.4 feet, one fixture per bay will be satisfactory. Therefore the dimensions of the rectangles to be illuminated from one center outlet are 17' 0"x12' 4".

(2) *Wattage Required.*

For a general office 1.25 watts per square foot (Table 3, Page 13) should be used. Multiply the area of one rectangle (17' 0"x12' 4"), 208 square feet, by 1.25, and obtain 260 watts.

(3) *Number of Lamps per Fixture.*

Suppose it is desired to use single unit fixtures. A 250-watt lamp obviously is the nearest size of lamp which will be satisfactory. (See page 7).

(4) *Type of Reflector and Length of Suspension.*

Referring to Table 2, the reflector called for in this case is a distributing type, 42-48 inches to the ceiling.

Table 2 - Class "A" Installations.

Ceiling height in feet	Type of reflector and length of suspension in inches required for rooms of various dimensions.												Concentrating 54"-66"				Distributing 60"-72"			
20'																				
19'																				
18'													Concentrating 48"-60"				Distributing 48"-60"			
17'																				
16'													Concentrating 42"-54"				Distributing 42"-54"			
15'													Concentrating 42"-48"				Distributing 42"-48"			
14'													Distributing 42"-48"							
13'													Distributing 36"-42"							
12'													Distributing 30"-36"							
11'													Distributing 24"-36"							
10'													Distributing 24"-30"							
9'													Distributing 18"-24"							
8'													Distributing 18"				Maximum dimension in feet of rectangle that can be illuminated from one center outlet.			
4' 8' 12' 16' 20' 24' 28' 32' 36' 40'																				

Class A Installations—Ceiling Outlets OFFICE BUILDINGS

(See Plate No. 1)

Curtis Publishing Company

Large employers of labor realize that human efficiency is quite as important as machine efficiency, and that equipment which will add to the convenience and comfort of the employees, keep their good will, and most important of all, conserve their health and strength, is a paying investment.

For this reason the Curtis Publishing Company, when considering the lighting system for its new office building, retained the services of a committee of five professional men, who gave a year of careful study to the question. A very exhaustive investigation of all modern systems of illumination was made, in which the original cost, cost of operation, cost of maintenance and depreciation were weighed against the seeing efficiency or visual acuity of the eye. As a result indirect lighting was selected and installed in all the offices.

The press rooms, pump rooms, etc., are equipped with X-RAY direct lighting equipment. (See page 41).



Curtis Publishing Company, Philadelphia, Pa.
Edgar V. Seeler, Architect



Armour & Co., Chicago

R. C. Clark, Architect

Butler Bros.

The offices and salesrooms of the new Butler Bros. Building, which is 15 stories high and covers a city block, are equipped with 1600 indirect fixtures. The print shops are illuminated with X-RAY direct lighting. (See page 39).

Illumination Calculations

General Offices, Butler Bros.

- (1) *Spacing and Number of Fixtures.*
Typical bay 20' 0" x 16' 6". Ceiling 12'. Fixtures per bay 4. Area of rectangle illuminated from one fixture 10' x 8' 3" = 82.5 sq. ft.
- (2) *Wallage Required.*
(Table 3)
 $1.25 \times 82.5 = 103$ watts.
- (3) *Number of Lamps per Fixture.*
1-100-watt.
- (4) *Type of Reflector and Length of Suspension.*
(Tables 1-2)
E-100 Reflector.
30" from top of reflector to ceiling.

Armour & Co.

The Armour Building occupies an area of 22,750 sq. ft., and is five stories in height. The major portion of the building is laid out in large open areas, which are used for general office work.

Indirect illumination is used throughout the building. Some 900 fixtures are installed.

Installation Data

General Offices, Armour & Co.

Typical bay 17' 0" x 21' 0"	Ceiling 15' 6"
No. of fixtures 4	Lamps per fixt. 1-100 watt
Type of reflector E-200	Length of suspension 24"

Table 3. Watts Per Sq. Ft. for Office Buildings

General	1.25—1.50	Private	1.00—1.25
Stenographic	1.25—1.75	Accounting	1.25—1.75
Vaults and Filing	0.75—1.00	Stock Room	0.75—1.25
Consultation R'm.	1.00—1.25	Reception Room	0.75—1.00
Lobby	1.00—1.50	Corridor	0.50—0.75

These values apply to the use of light ceilings (white, cream or light ivory) high efficiency X-RAY EYE COMFORT Reflectors, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.



Butler Bros., Chicago

D. H. Burnham & Co., Architects

Class A Installations—Ceiling Outlets

BANKS

(See Plate No. 2)



Peninsular State Bank, Detroit, Mich.
Donaldson & Meier, Architects

Peninsular State Bank

As shown on the plan and elevation, this banking space is illuminated by means of a combination indirect and direct lighting through the skylight. The latter type of lighting is fully treated under Direct Lighting (page 43). The direct lighting is of a very diffuse nature and does not detract from the indirect illumination. No cage or grill illumination is provided, nor are desk lamps of any sort installed. The general illumination is entirely sufficient for the most exacting work.

Approximately 110 indirect fixtures are installed.

Illumination Calculations
Banking Space

- (1) Spacing and Number of Fixtures.
The architecture of the ceiling determines the number and spacing of fixtures and the length of suspension in this particular installation. (See Ceiling Plan).
- (2) Wattage Required.
(Table 4).
 $2.0 \times 2570 = 5140$ watts.
- (3) Number of Lamps per Fixture.
16 indirect fixtures.
1-250 watt lamp each.
24 Direct lighting reflectors (above skylight).
1-60 watt lamp each.
- (4) Type of Reflector and Length of Suspension.
(Tables 1 and 2).
16 indirect fixtures.
E-255 reflector.
5' 0" from top of reflector to ceiling.
24 No. 555 reflectors above skylight.

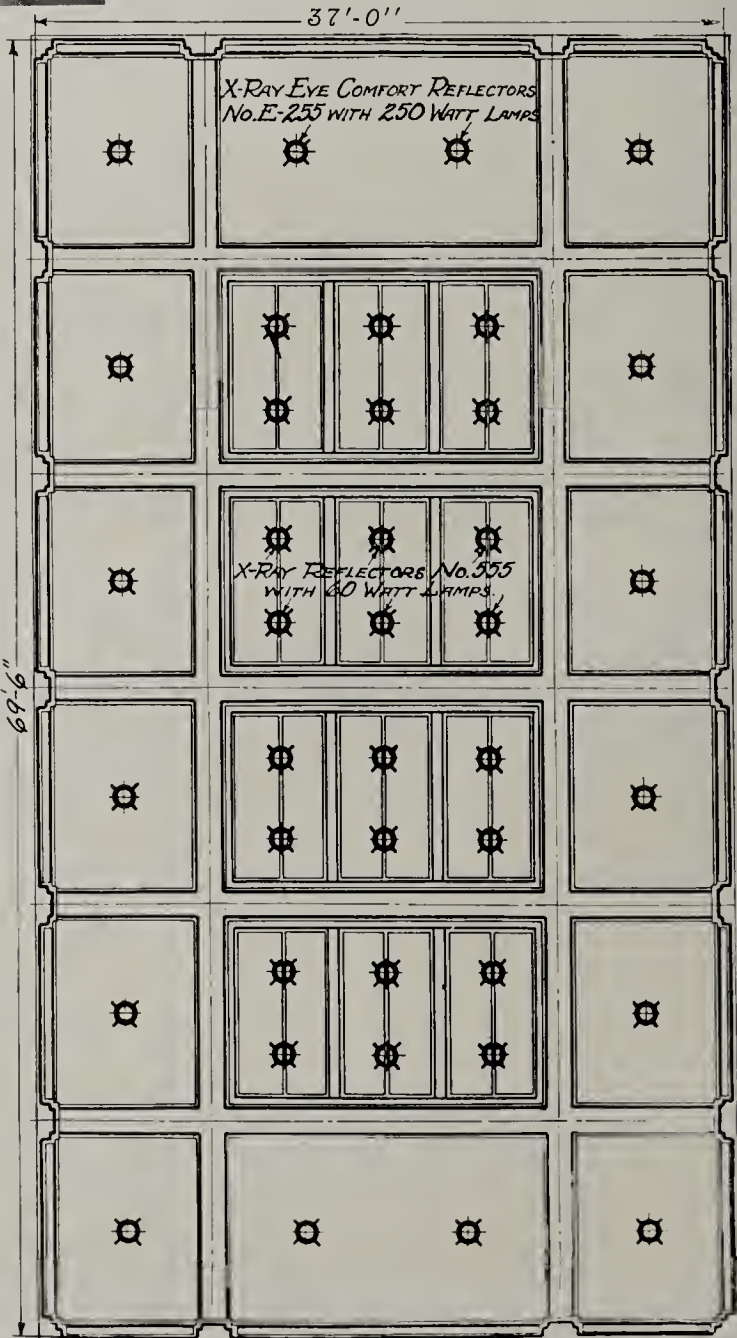
Table 4. Watts Per Sq. Ft. for Banks

Banking Space	1.25—2.00	Public Space	0.75—1.25
General Office	1.25—1.50	Private Office	1.00—1.25
Stenographic Room	1.25—1.75	Accounting Room	1.25—1.75
Consultation Room	1.00—1.25	Vaults and Filing	0.75—1.00

These values apply to the use of light ceilings (white, cream or light ivory), high efficiency X-RAY EYE COMFORT reflectors, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.



Section



Ceiling Plan

Class A Installations—Ceiling Outlets
HOTELS AND CLUBS



Auditorium Hotel, Chicago, Ill.

Table 5. Watts Per Sq. Ft. for Hotels and Clubs

Barber Shop	1.00—1.25
Card Room	1.00—1.50
Sample Room	1.50—2.00

These values apply to the use of light ceilings (white, cream or light ivory,) high efficiency X-RAY EYE COMFORT reflectors, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.

It is apparent to everyone that indirect lighting adds greatly to the comfort of the patrons of a barber shop.

Installation Data

Barber Shop, Auditorium Hotel

Size 23' 0" x 40' 0"	Ceiling 10' 0"
No. of fixtures 6	Lamps per fixture 1-150 watt
Type of reflector E-200	Length of suspension 24"

LIBRARY BUILDINGS

(See Plate No. 10)

Milwaukee Public Library

A library room, without countless table lamps to obstruct the view, is an achievement. The reading room of the Milwaukee Public Library, is a good example of how this may be accomplished. The entire reading space is flooded with an even intensity of illumination on the working plane (plane of the tables) by the indirect fixtures 36 feet above. The diffuse character of the illumination eliminates sharp shadows and glare.

Illumination Calculations

Reading Room, Chicago Public Library

- (1) Spacing and Number of Fixtures.
Typical bay 48' 0" x 18' 0"—Ceiling 15' 4"
Fixtures per bay—3.
Area illuminated from one fixture 16' 0" x 18' 0"—288 sq. ft.
- (2) Wattage required.
(Table No. 6).
 $1.5 \times 288 = 432$ watts.
- (3) Number of Lamps per Fixture.
1-400 watt.
- (4) Type of Reflector and Length of Suspension.
(Tables 1 and 2).
E-500 Reflector.
42" from top of reflector to ceiling.



Public Library, Milwaukee, Wis. Ferry & Clas, Architects
Vaughn, Meyer & Sweet, Consulting Engineers

A catalogue room equipped with properly designed indirect lighting fixtures will require no local illumination at the card cases. The diffused illumination penetrates into the drawers making it unnecessary to remove the cards.

Table 6. Watts Per Sq. Ft. for Library Buildings

Lobby	0.75—1.00	Corridor	0.50—0.75
Delivery Room	1.00—1.25	Catalogue Room	1.00—1.25
Reading Room	1.25—1.75	Lecture Room	0.75—1.25

These values apply to the use of light ceilings (white, cream or light ivory,) high efficiency X-RAY EYE COMFORT reflectors and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.



Chicago Public Library, Chicago, Ill.
Shepley Rutan & Coolidge, Architects

Class A Installations—Ceiling Outfits

STORES AND DISPLAY ROOMS

(See Plate No. 8)



Third Floor, Hub Store, Chicago

Marshall & Fox, Architects



Barnum Trunk Co., Minneapolis, Minn.

The Hub

The illumination of a high-class store for men, such as the Hub, requires something distinctive in the character of the lighting equipment. The main floor of the Hub, shown on Plate No. 8, is equipped with luminous bowls of special design.

The basement and upper seven floors, have specially designed Com-pone fixtures.

Illumination Calculations*Third Floor, The Hub.*(1) *Spacing and Number of Fixtures.*

Typical bay 22' 6" x 22' 6".

Ceiling 13' 6".

Fixtures per bay 4.

Area illuminated from one fixture, 11' 3" x 11' 3" = 126.5 sq. ft.

(2) *Wattage Required.*

(Table 7).

 $2.0 \times 126.5 = 253$ watts.(3) *Number of Lamps per Fixture.*

1-250 watt.

(4) *Type of Reflector and Length of Suspension.*

(Tables 1 and 2).

E-250 reflector.

36" from top of reflector to ceiling.

The Lytton Bldg., Home of The Hub
Chicago**Barnum Trunk Co.**

The leather goods department of the Barnum Trunk Co., illustrates the successful solution of adequately illuminating a salesroom in which chiefly dark goods are displayed. The goods stand out in clear detail and true color values.

Installation Data*Salesroom, Barnum Trunk Co.*

Typical bay 20' 0" x 20' 0".

Ceiling 15' 0".

Number of fixtures 1.

Lamps per fixture 4-150 watt.

Type of reflector E-200.

Length of suspension 48".

Albert Breitung

Size 60' 0" x 18' 0".

Ceiling 12' 0".

Number of fixtures 3.

Lamps per fixture 8-60 watt.

Type of reflector E-60.

Length of suspension 30".

Table 7. Watts per Sq. Ft. for Stores and Display Rooms

Dark Display 1.50—2.25

Light Display 1.25—1.75

These values apply to the use of light ceilings (white, cream or light ivory), high efficiency X-RAY EYE COMFORT reflectors, and clear bulb lamps. They cover a permissible decrease in illumination intensity of 25 per cent, due to dust accumulation, etc.



Albert Breitung Cigar Store, Chicago

Kohler & Chase, Musical Instruments, Seattle, Wash.
Bebb & Mendel, Architects

Class A Installations—Ceiling Outlets
SCHOOLS
(See Page Three)

Boys High School

Undoubtedly the school, next to the home, is the place to begin conserving the vision of our future generations by supplying comfortable and sufficient illumination. Indirect lighting is particularly well adapted to the class room. It will supply sufficient illumination on each desk, and it will be impossible for a pupil to cast annoying shadows on his neighbor's desk. The Boys High School, of which an exterior and several interior views are shown on page 3, is equipped throughout with indirect lighting; 154 Compone fixtures of special design are used.

Illumination Calculations
Class Room, Boys High School

- (1) *Spacing and Number of Fixtures.*
Size of Room 25' 0" x 35' 0" Ceiling 13' 0"
Total fixtures 2
Area illuminated from one fixture 25' 0" x 17' 6" = 438 sq. ft.
- (2) *Wattage Required.*
(Table 8)
1.25 x 438 = 547 watts.
- (3) *Number of Lamps per Fixture.*
5-100 watt.
- (4) *Type of Reflector and Length of Suspension.*
(Tables 1 and 2).
E-100 reflector.
42" from top of reflector to ceiling.

Installation Data
*Chemical Laboratory,
Boys High School*

Size 25' 0" x 41' 0"
Ceiling 13' 0"
Number of fixtures 3
Lamps per fixture 5-100 watt
Type of reflector E-100
Length of suspension 36"



Boys High School, New Orleans, La.
E. A. Christy, Architect



Rugby School, Rugby, England. Sir Thomas Jackson, Architect
Installation made by British Thomson-Houston Co., Ltd.

Rugby School

The historic temple speech room of Rugby School has recently been equipped with indirect lighting. Installation data is given on the plan and section. The large center fixture is equipped with E-255 reflectors and the remainder, E-200 reflectors.

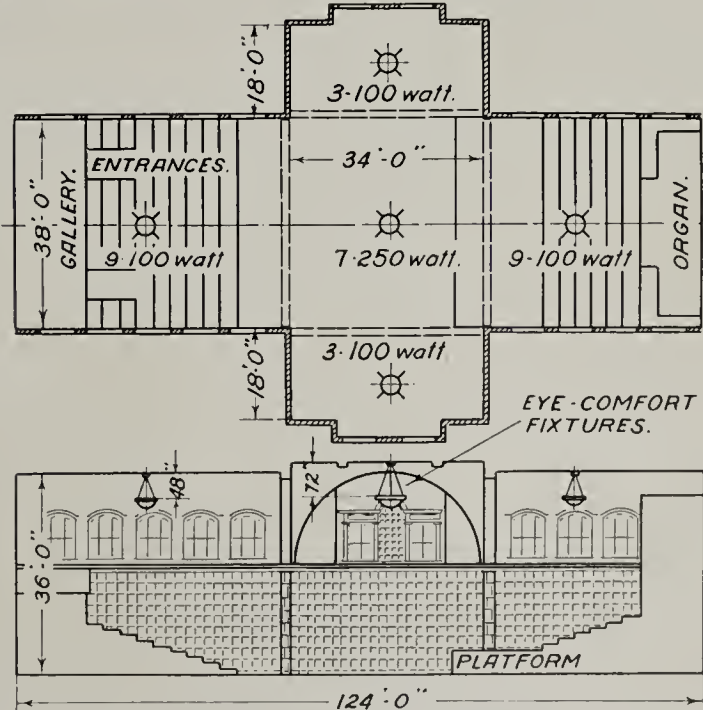
Table 8. Watts per Sq. Ft. for Schools

Class Room.....	0.75—1.25
Class Room (Business College).....	1.25—1.50
Laboratory.....	1.00—1.75
Museum.....	0.75—1.00
Assembly Hall.....	0.75—1.25

These values apply to the use of light ceilings (white, cream or light ivory), high efficiency X-RAY EYE COMFORT reflectors, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.



Boys High School, New Orleans



Plan and Section, Rugby School

CLASS B INSTALLATIONS

(See Plates 3 and 11)

Included in this class are the following types of installations, in which a *uniform* and *extremely diffuse* and perfectly *shadowless* illumination on the working plane (plane of tables or desks) is required:

- Drafting Rooms
- Operating Rooms
- Large Sewing Rooms (Tailoring establishments)

(1) Spacing and Number of Fixtures.

Divide the area to be illuminated, or a typical bay, into a number of equal rectangles (approximate squares). For ceiling heights up to and including 12 feet, the maximum dimension of the rectangle should not exceed 0.75 times the ceiling height; above 12 feet the maximum should not exceed the ceiling height.

(2) Wattage Required.

Select from the subsequent tables, the watts per square foot required for the particular interior. Multiply the area of one rectangle obtained from (1) by this quantity and obtain the required wattage per outlet or fixture.

(3) Number of Lamps per Fixture.

Knowing the watts per fixture and the wattage of the lamp it is desired to use, the number of lamps per fixture may be readily obtained.

(4) Type of Reflector and Length of Suspension.

Select from Table 9 the length of suspension required for the size of rectangle obtained from (1) and the ceiling height under consideration. Refer to Table 1 for the reflector number corresponding to the size of lamp to be used.

An excellent drafting room installation is illustrated on Plate No. 3.

No desk lamps are required. The fixtures are overhead and out of the way. The tables may be placed in any position desired. There are no shadows on the working plane, (plane of the table) so that a person is "never in his own light."

Plate No. 11 illustrates and gives complete data on an operating room. Here again the illumination on the table is shadowless; the fixtures are up high, eliminating the danger of infecting the wound due to dust shaken from the lighting equipment, and protecting the patient from the heat of the lamps.

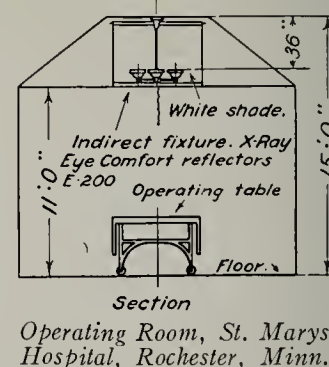
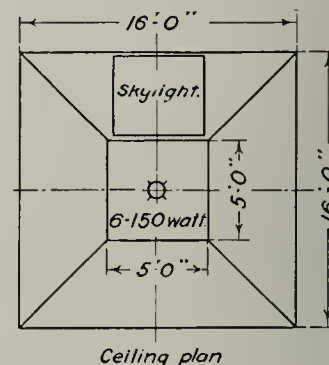


Table 10. Watts Per Sq. Ft. for Class B Installations

Drafting Rooms	2.25—2.75
Operating Rooms	2.50—3.75
Sewing Rooms (Large)	2.25—2.75

The values apply to the use of light ceilings (white, cream or light ivory), high efficiency X-RAY EYE COMFORT reflectors, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.

Table 9 - Class "B" Installations.

Ceiling height in feet	Type of reflector and length of suspension in inches required for rooms of various dimensions.										Distributing 54"-72"									
	2'	4'	6'	8'	10'	12'	14'	16'	18'	20'	2'	4'	6'	8'	10'	12'	14'	16'	18'	20'
20'																				
19'																				
18'																				
17'																				
16'																				
15'																				
14'																				
13'																				
12'																				
11'																				
10'																				
9'																				
8'																				

Maximum dimension in feet of rectangle that can be illuminated from one center outlet.

CLASS C INSTALLATIONS

Class C embraces installations where the *artistic* and *aesthetic* play a very important part, and where uniformity of illumination is of less importance, and hence must necessarily be sacrificed to the former qualities. This class of interiors may be treated in numerous ways, from ceiling, floor, cornice, bracket outlets, etc.

Included in it are the following types of interiors:

- Hotels and Clubs

Ball Room

Buffet

Dining Room

Lobby

Lodge Room
- Churches and Auditoriums

Hospitals

Railway Stations

Residences

Theatres

In planning installations of this class, it is not possible to give one method of procedure which will apply to all cases; in fact, individual cases require separate methods of treatment.

Spacing and Number of Fixtures.

The spacing of units in many cases is dependent on the architectural features of the interior as well as the dimensions of the room.

Wattage Required.

The required wattage may be obtained from the subsequent tables of watts per sq. ft. for various interiors.

Type of Reflector and Length of Suspension.

Flat Ceilings

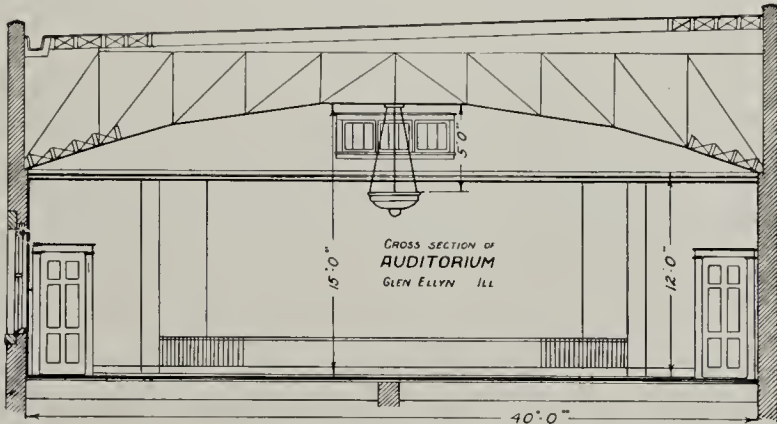
The length of suspension for flat ceilings is largely a matter of proper proportions and artistic appearance. Care should be exercised, however, to permit no light to strike the walls directly. Chart No. 1 gives the ceiling spread on flat ceilings, for the concentrating and dis-

tributing types of reflectors for various lengths of suspension. A fixture should never be located closer to the wall than one-half the ceiling spread.

Type of Reflector and length of Suspension.

Arched Ceilings

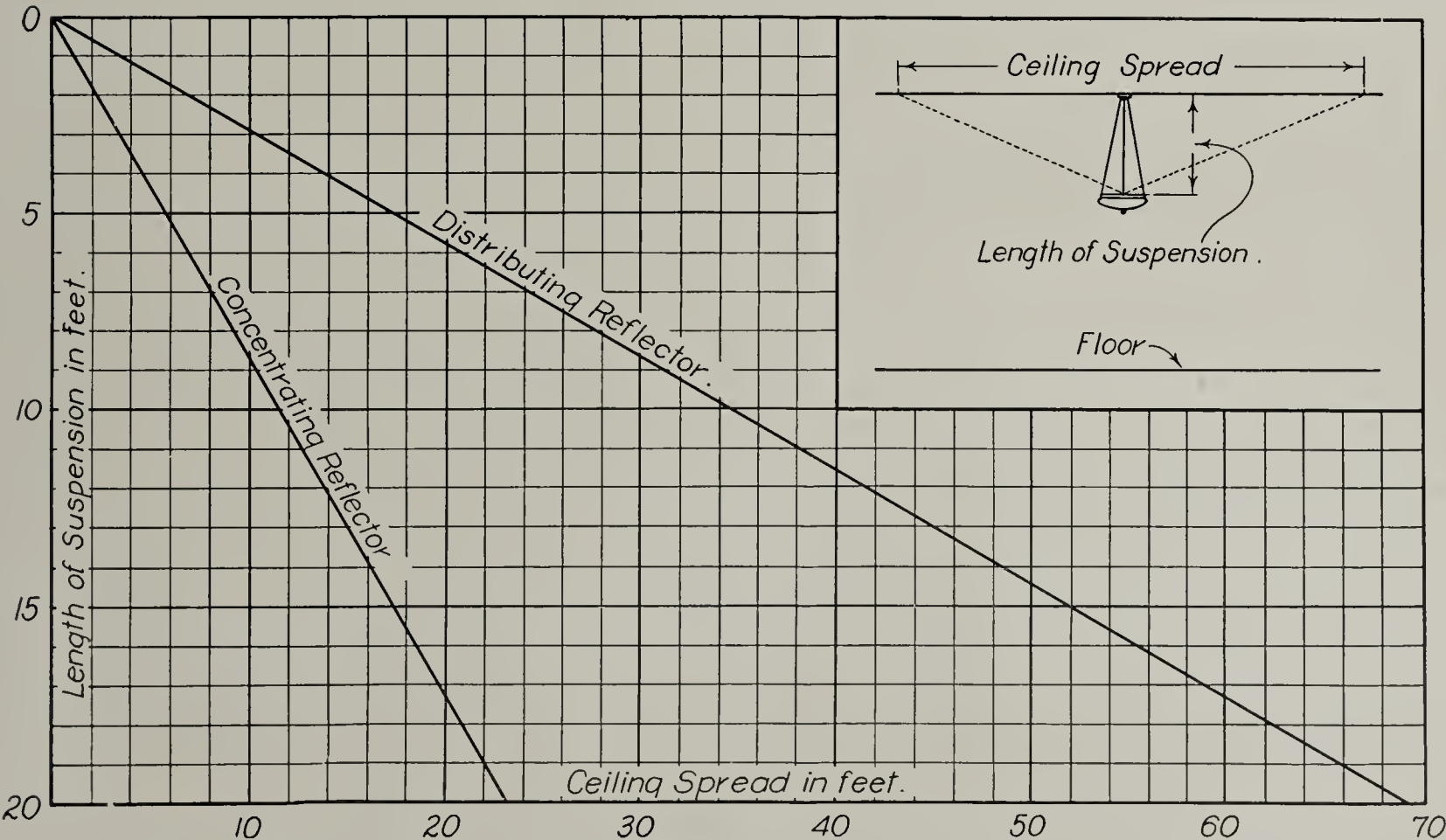
For arches in which the span does not exceed 3.5 times the rise, concentrating reflectors should be used, and the height of suspension should not exceed 0.75 of the rise. For arches where the span exceeds 3.5 times the rise, the distributing reflector should be used, and the length of suspension may equal, and in some cases exceed the rise. For arches having only a very slight curvature, Chart No. 1 may be applied in determining the length of suspension.



Installation Data

Size 40' 0" x 60' 0"	Ceiling height 15' 0"
No. of fixtures 3	Lamps per fixture 7-100 watt
Type of reflector E-100	Length of suspension 5' 0" *

Chart No. 1. - Class "C" Installations.



*Obviously the correct length of suspension for best appearance is 5' 0" which is safely within the limits of chart No. 1.



Evangelical Trinity Church
Milwaukee, Wis.
Schnetzky and Son - Architect



Eighth Church of Christ Scientist - Chicago
Leon E. Stanhope Architect



Saint Cyril's Roman Catholic Church
Chicago
Joseph Molitor - Architect



First Presbyterian Church
Clarinda, Iowa



North Chicago Hebrew Church
Chicago
Alfred S. Alschuler Architect

Class C Installations—Ceiling Outlets

CHURCHES AND AUDITORIUMS

(See Plate 6)

Eberhardt Memorial Church

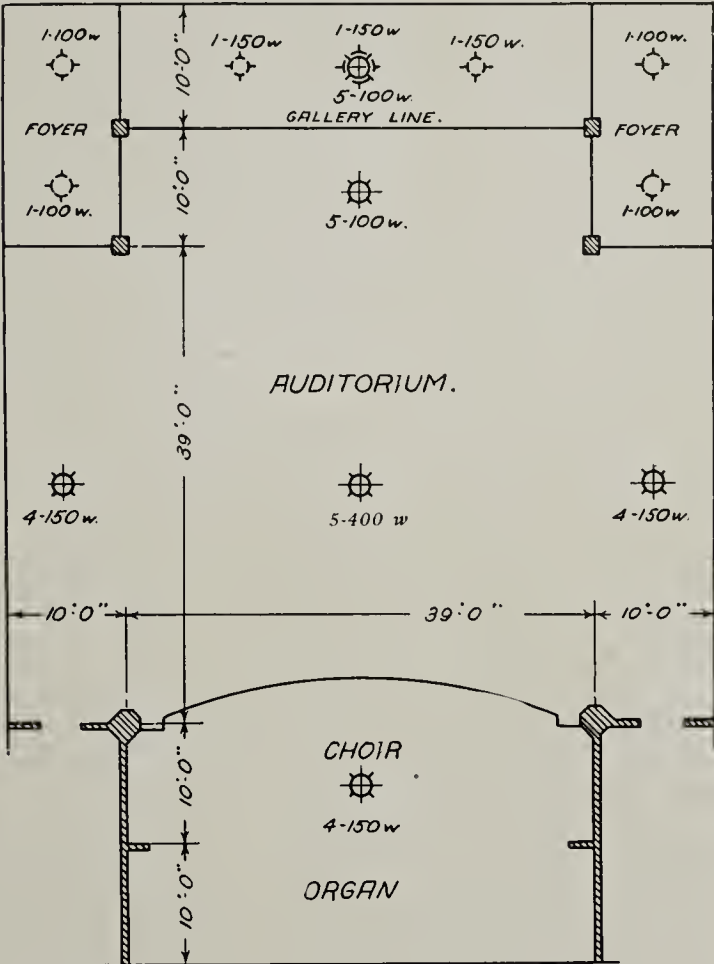
The illustrations show a very striking example in which the lighting equipment is made a part of the architecture. The Compone fixtures are Gothic in design, and special provision is made in the ceiling construction for the reception of the fixture canopies. Each of the large fixtures, suspended from the main vaulted ceiling, is equipped with a windlass, which permits lowering the fixtures for cleaning and lamp renewals.

Illumination Calculations

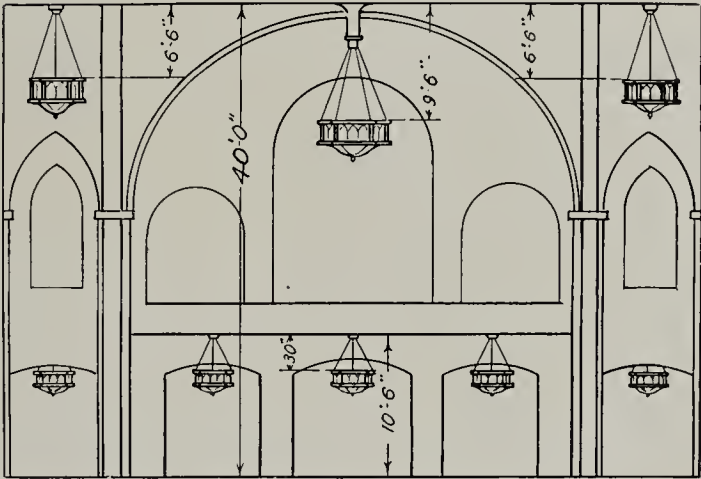
Nave, Eberhardt Memorial Church

- (1) Spacing and Number of Fixtures.
A single fixture at the center of the nave obviously is the only possible arrangement.
- (2) Wattage Required.
(Table 11).
 $1.25 \times 1520 = 1900$ watts.
- (3) Number of Lamps per Fixture.
5-400 watt.
- (4) Type of Reflector and Length of Suspension.
(Table 1 and Arched ceiling data.)
E-255 reflector.
9' 6" from top of reflector to ceiling.

NOTE:—This fixture helps to illuminate the transepts and fixtures in transepts help illuminate the nave. The total required wattage however should be proportioned among the various fixtures according to areas served. (See Plan).



Plan



Section



Eberhardt Memorial Church, Mishawaka, Ind.
Badgley & Nicklas, Architects, Cleveland, O.



Table 11. Watts Per Sq. Ft. for Churches and Auditoriums

Auditorium	0.75—1.25	Sunday School R'm.	0.50—1.00
Vestibule	0.75—1.00	Foyer	0.75—1.00
Pastor's Study	0.50—1.00	Choir Room	0.50—1.00

These values apply to the use of light ceilings (white, cream or light ivory), high efficiency X-RAY EYE COMFORT reflectors, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.



Grove Park Inn
Asheville, N.C.



Beverly
Hills
Hotel
Elmer Grey
Architect
Los Angeles, Cal.



Lounge
Grove Park Inn



Blackstone Hotel Chicago
Marshall and Fox Architects

Class C Installations—Ceiling Outlets

HOTELS AND CLUBS

More new and novel ideas have been worked out in connection with the illumination of the lobbies, dining rooms, ball rooms, and lodge rooms of hotels by indirect methods, than for any other class of interiors. Specially designed ceiling fixtures, floor pedestals and urns, floor and table lamps, cornices and brackets, all have found application. Pages 29, 31, 32 and Plates Nos. 4 and 5 show a number of examples.

Beverly Hills Hotel

The indirect fixtures in the lobby of the Beverly Hills Hotel are decidedly in keeping with the scheme of decoration.

Illumination Calculations
Lobby, Beverly Hills Hotel

- (1) Spacing and Number of Fixtures.
Typical Bay 20' 0" x 17' 0" Ceiling 13' 6"
Fixtures per bay 1.
Area of rectangle illuminated from one fixture 20' 0" x 17' 0"=340 sq. ft.
- (2) Wattage Required.
(Table 12).
1.5 x 340=510 watts.
- (3) Number of Lamps per Fixture.
5-100 watt.
- (4) Type of Reflector and Length of Suspension.
(Table 1 and Chart 1).
E-100 Reflector.
42" from top of reflector to ceiling.



Beverly Hills Hotel, Beverly Hills, Cal.
Elmer Grey, Architect, Los Angeles

Deutscher Club

The ball room of the Deutscher Club, illustrates what beautiful effects may be obtained by properly combining the artistic and engineering features involved in the solution of lighting problems. In addition to the central fixtures, auxiliary lighting for scenic effects is obtained from the indirect brackets installed on the pilasters.

These are each equipped with one Visor reflector and one 150-watt lamp, (see page 32 for similar detail). Colored glass screens, are provided for obtaining numerous novel lighting effects during the progress of a ball or banquet.

If, for instance, a soft and subdued moonlight effect is desired, amber glass screens are placed over the pilaster units, and the central fixtures extinguished.

Installation Data
Ball Room

Size 60' 0" x 90' 0"	Ceiling 34' 0"
Number of fixtures 3	Lamps per fixture 3-500 watt
Type of reflector E-500	Length of suspension 60"



Lakota Hotel, Chicago, Ill. W. W. Clay, Architect

Lakota Hotel
Installation Data
Dining Room

Typical bay 19' 0" x 19' 6"	Ceiling 14' 0"
Number of fixtures 1	Lamps per fixture 3-150 watt
Type of reflector E-150	Length of suspension 48"

Table 12. Watts per Sq. Ft. for Hotels and Clubs

Ball Room.....	1.00—1.25
Buffet.....	1.25—1.75
Corridor.....	0.50—1.00
Dining Room.....	0.75—1.25
Lobby.....	1.25—1.50
Lodge Room.....	1.00—1.25
Lounging Room.....	0.75—1.25

These values apply to the use of light ceilings, (white, cream or light ivory) high efficiency X-RAY EYE COMFORT reflectors, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.



Deutscher Club, Milwaukee, Wis.

Class C Installations—Ceiling Outlets

HOSPITALS



Milwaukee Hospital, Milwaukee, Wis.
Meyer J. Sturm, Hospital Architect, Chicago, Ill.

A patient lying on his back in a hospital is at the lowest ebb of his vitality. Nothing will cause him more annoyance, pain, and nervous strain than to be compelled to gaze at a brilliant light source. Hence the advent of indirect lighting was welcomed heartily by hospital managements and today it is considered a most essential part of the standard hospital equipment.

For Ward lighting it has proved very satisfactory to control each fixture by an electrolier switch at the fixture or by a suitable switch on the wall, arranged to give at least two intensities of illumination and in some cases three:

- (1) A low intensity to enable the nurses to wait on the patients at night. (0.25–0.5 watts per sq. ft.)
 - (2) A medium intensity for reading, etc. (0.5–1.0 watts per sq. ft.)
 - (3) A high intensity for medical examinations at the beds. (1.0–1.5 watts per sq. ft.)
- Frequently (3) is omitted and wall plugs between the beds provided.

Isolation Hospital
Illumination Calculations
Typical Ward

- (1) *Spacing and Number of Fixtures.*

Size of room 33' 6" x 74' 0" Ceiling 15' 0".

Number of fixtures 7.

Area illuminated from one fixture (33' 6" x 10' 7") = 356 sq. ft.



Harper Hospital, Detroit, Mich.
Malcolm V. Higginbotham, Architect

- (2) *Wattage Required.*

(Table 13).

$$1.25 \times 356 = 445 \text{ watts.}$$

- (3) *Number of Lamps per Fixture.*

4-100 watts and 1-60 watt.

Each fixture is controlled by an electrolier switch which gives 60 watts for dim, 360 watts for medium, and 460 watts for bright illumination.

- (4) *Type of Reflector and Length of Suspension.*

(Table 1 and Chart No. 1).

E-100 reflector.

50" from top of reflector to ceiling.

Milwaukee Hospital

Private Room (Surgical Wing)

Size 14' 6" x 16' 6"

Ceiling 11' 6"

Number of fixtures 1

Lamps per fixture 4-40 watt

Type of reflector E-60

Length of suspension 48"

Table 13. Watts per Sq. Ft. for Hospitals

Corridor.....0.25
Operating Rooms, (See Class B—Page 18)

Ward

Dim (night light).....0.25—0.5

Medium (reading).....0.50—1.0

Bright (medical examinations).....1.00—1.5

These values apply to the use of light ceilings (white, cream or light ivory), high efficiency X-RAY EYE COMFORT reflector, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.



Isolation Hospital, Milwaukee, Wis. Chas. E. Malig, Architect



Harper Hospital, Detroit, Mich.

Class C Installations—Ceiling Outlets

RAILWAY STATIONS



Chicago, Indianapolis & Louisville R. R., Hammond, Ind.
Marshall & Fox, Architects, Chicago

The new Union station at Memphis which is illuminated with indirect lighting shows the growing tendency on the part of the railroads to add to the comforts of the traveling public.

A number of railroads have made indirect lighting part of the standard equipment of station waiting rooms, ticket offices, etc. Some roads have had standard fixtures made up with their monogram or trade marks incorporated in the design of the bowl. For instance the Canadian Northern R. R., has adopted the fixture shown in the illustration of the Winnipeg ticket office, as the standard fixture for all the offices of the entire system.

Chicago, Indianapolis & Louisville R. R.

Illumination Calculations

Station Waiting Room

- (1) *Spacing and Number of Fixtures.*
- Size 55' 0" x 20' 0" Ceiling 18' 0".
- Number of fixtures 3.
- Area illuminated from one fixture 366 sq. ft.



The Central Station, Memphis, Tenn. D. H. Burnham & Co., Architects, Chicago



Canadian Northern R. R., Winnipeg, Can.

- (2) *Wallage Required.*
- (Table 14).
- $1.3 \times 366 = 476$ watts.
- (3) *Number of Lamps per Fixture.*
- 5-100 watt.
- (4) *Type of Reflector and Length of Suspension.*
- (Table 1 and Chart No. 1).
- E-100 reflector.
- 60" from top of reflector to ceiling.

Table 14. Watts Per Sq. Ft. for Railway Stations		
Main Waiting Room		1.25—1.75
Ticket Office	(See Class A—Installations)	1.25—1.50
Ladies' Retiring Room		0.75—1.25
Smoking Room		0.75—1.25
Barber Shop	(See Class A—Installations)	1.00—1.25
Dining Room		0.75—1.25

These values apply to the use of light ceilings (white, cream or light ivory), high efficiency X-RAY EYE COMFORT reflectors, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.

Class C Installations—Ceiling Outlets

RESIDENCES

In view of the fact that the eyesight is the faculty which most often and most markedly declines with advancing years, the illumination of the home should receive the careful attention of the householder. In the evening, when after a day's activity the eyes are tired, a soft, diffuse and restful illumination is most gratifying.



Dining Room

Size 16' 0" x 19' 6"
Number of fixtures 1
Type of reflector E-60
Ceiling 9' 6"
Lamps per fixture 4-60 watt
Length of suspension 27"



Bed Room

Size 14' 0" x 16' 0"
Number of fixtures 1
Type of reflector E-100
Ceiling 9' 0"
Lamps per fixture 1-60 watt
Length of suspension 20"

Table 15. Watts per Sq. Ft. for Residences

Living Room	0.75—1.00	Den	0.75—1.00
Reception Room	0.75—1.00	Music Room	0.50—0.75
Sun Parlor	0.75—1.00	Bed Room	0.25—0.50
Dining Room	0.50—0.75	Hall	0.25
Bath Room	0.25—0.50	Porch	0.25—0.75
Library	0.75—1.00	Children's Play R'm	0.50—0.75

These values apply to the use of light ceilings (white, cream or light ivory), high efficiency X-RAY EYE COMFORT reflectors, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.



Living Room

Size 12' 0" x 15' 0"
Number of fixtures 1
Type of reflector E-60
Ceiling 9' 0"
Lps. per fix. (2-60 wt. 1-25 wt.)
Length of suspension 30"



Dining Room
(Luminous Bowl Fixture)

Size 12' 0" x 14' 0"
Number of fixtures 1
Type of reflector E-60
Ceiling 9' 0"
Lamps per fixture 3-40 watt
Length of suspension 30"



Porch

Size 8' 0" x 32' 0"
Number of fixtures 1
Type of reflector E-100
Ceiling 9' 6"
Lamps per fixture 1-100 watt
Length of suspension 20"

Class C Installations—Ceiling Outlets

THEATRES

(See Plate No. 7)

The theatre of former days was "much lighted" with its myriads of bare lamps outlining the proscenium arch, the balcony, the ceiling beams, etc., but it takes quite a stretch of imagination to say it was "well lighted." Today the tendency is to do away with all this garish display, and provide a moderate and comfortable illumination.

Indirect lighting equipment meets the demand for ornamental fixtures, and provides the means of displaying the interior decorations of the ceiling and walls to the best advantage, as well as giving a comfortable, well diffused illumination, as illustrated by the accompanying views of a theatre in England.

The need of illuminating a moving picture theatre during the time the pictures are shown is recognized as a prime requisite. In many localities the law requires it. Aside from this consideration, however, proper illumination of the picture theatre adds to its attractiveness, removes the gloom of a dark house, reduces panic dangers, and without question increases attendance.

Indirect lighting is exactly suited to the purpose. The house may be illuminated to a moderate intensity, and the pictures shown just as well as in complete darkness. There are no bright lights to distract attention from the pictures, and cause the patrons discomfort.



Holderness Theatre, Hull, England
Installation made by British Thomson-Houston Co., Ltd.,
London, England

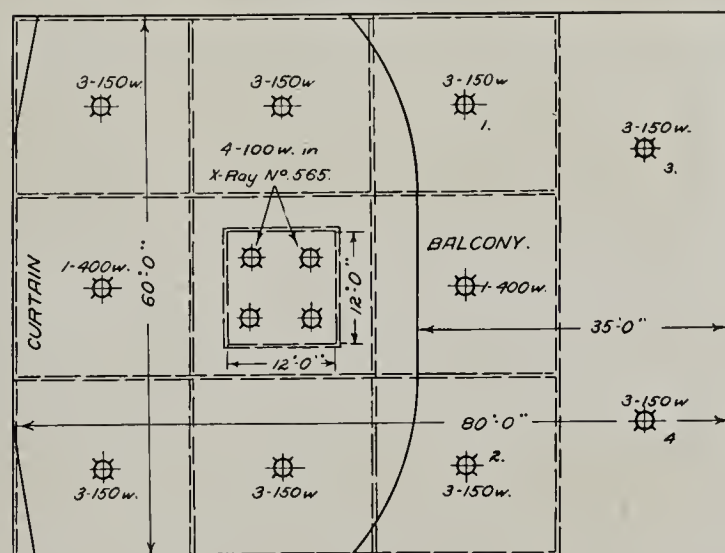


Holderness Theatre

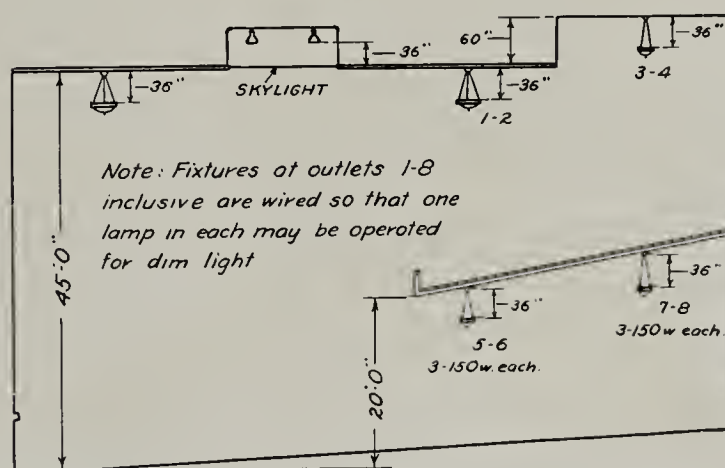
*The front of the theatre receives ample reflected light from the screen, for dim illumination; hence fixtures, within a distance of twice the ceiling height from the screen, need not be wired for dim lighting.



Holdersness Theatre



Plan



Section.

Table 16. Watts per Sq. Ft. for Theatres

Auditorium	1.00—1.50	Ladies' Retiring Room	0.75—1.25
Box Office	1.00—1.25	Lobby	1.50—2.50
Foyer	1.00—1.50	Smoking Room	0.75—1.25

Moving Picture Theatre

Dim illumination while pictures are shown*	0.20
Bright illumination during intermission	0.75—1.25

These values apply to the use of light ceilings (white, cream or light ivory), high efficiency X-RAY EYE COMFORT reflectors, and clear bulb tungsten lamps. They cover a permissible decrease in illumination of 25 per cent, due to dust accumulation, etc.

Class C Installations—Floor Outlets

PORTABLE ART LAMP EQUIPMENT

(See Plate No. 9)

Curtis Portable Adapters

Pedestals of metal, wood, and composition, large vases, heavy candle sticks or any suitable standards may be converted into beautiful indirect Art lamps by equipping them with Curtis Adapters of the various types shown below. *Standards for table lamps should not be less than 25 inches high, floor lamps 60 inches.*

Provision is made for the illumination of the silk shade of all the Curtis Adapters shown by providing them with a white diffusing plate which diffusely reflects the light passing through the bottom opening of the reflector. In addition to this, one of the adapters is equipped with three small direct lamps for illuminating the shade when the indirect illumination is not in use.

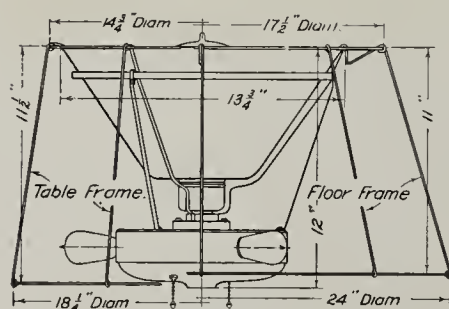


Fig. 1-a

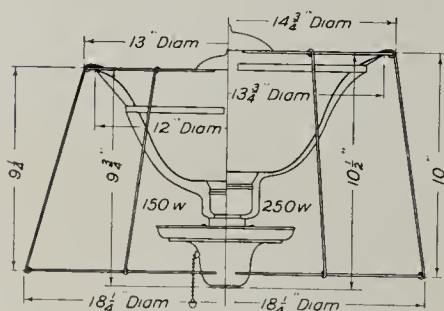


Fig. 2-a

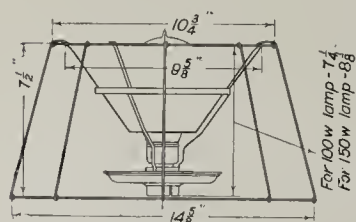


Fig. 3-a

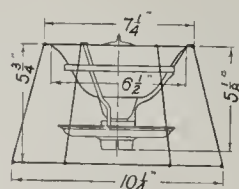


Fig. 4-a

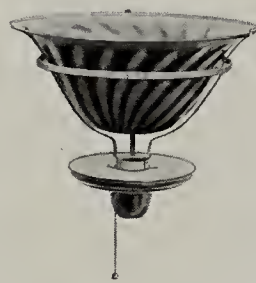


Fig. 2-b

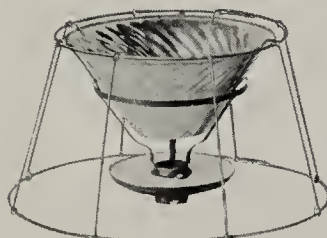


Fig. 3-b

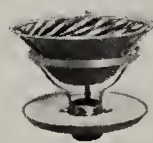


Fig. 4-b

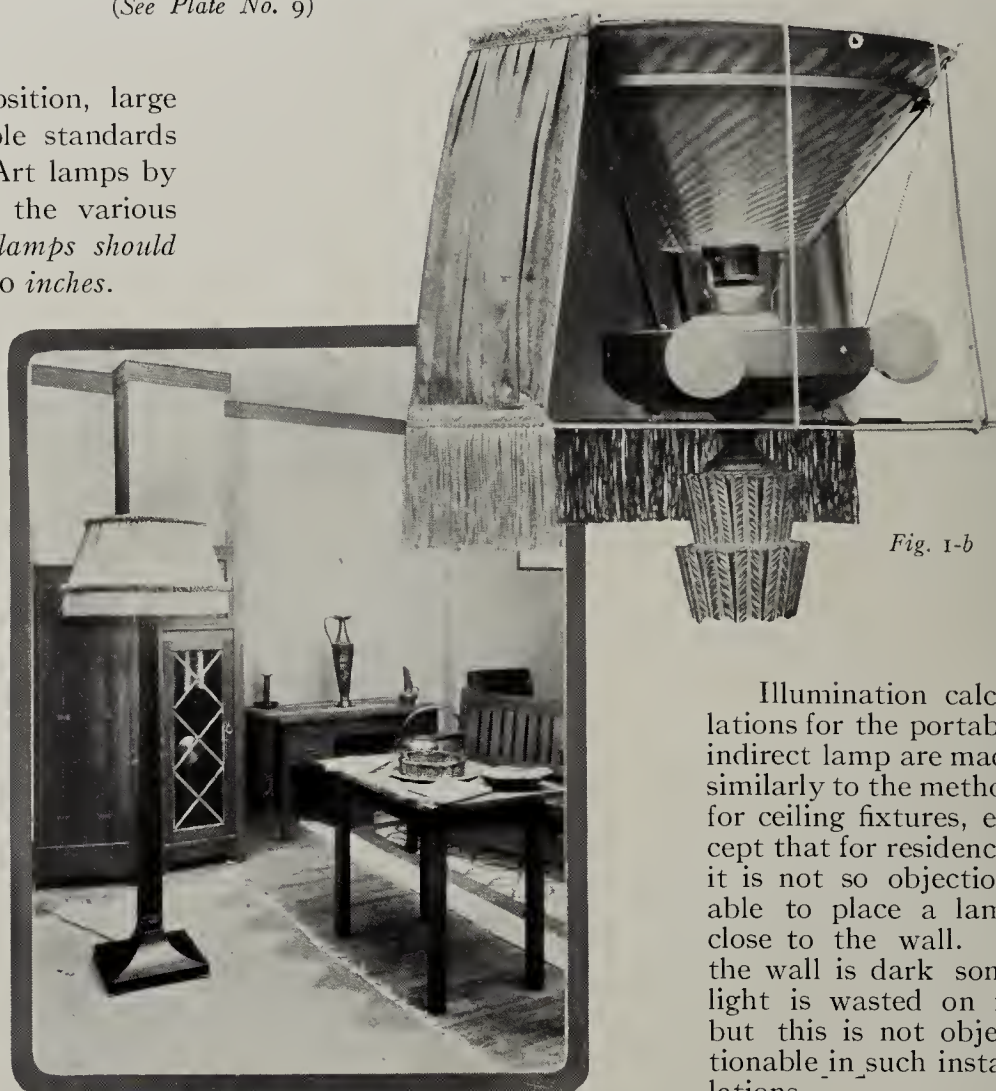


Fig. 1-b

Craftsman Bldg., New York City

Illumination calculations for the portable indirect lamp are made similarly to the method for ceiling fixtures, except that for residences it is not so objectionable to place a lamp close to the wall. If the wall is dark some light is wasted on it, but this is not objectionable in such installations.

Curtis Portable Adapters

For Large Table and Floor Lamps

With Small Direct Lighting Lamps (Fig. 1).

This adapter is shown complete, except the silk fabric for the shade, in the detail drawing. It is equipped with two pull switches for controlling the indirect and direct lamps separately. It is tapped $\frac{3}{8}$ " for fastening to top of pedestal.

Parts

Refl. E-250 or E-255	Lamps (indirect) 150 or 250
Refl. Holder and Supports	watt
Diffusing Disk (white)	Lamps (direct) 3-10 watt
	Wire Shade Frame

Without Direct Lighting Lamps

This adapter is shown in detail in the accompanying drawing in two sizes. It is equipped with one pull switch and is tapped $\frac{3}{8}$ " for fastening to top of pedestal.

Parts

Refl. E-150, E-250 or E-255	Lamps 100, 150 or 250 watt
Refl. Holder and Supports	Wire Shade Frame
Diffusing Disk (white)	

Curtis Adapters

For Small Table and Floor Lamps

Another type of adapter is shown in the accompanying sketches. It is constructed so that it will slip over a standard brass shell socket in the vertical position and is made in two sizes. It is readily fastened to any lamp standard having an upright socket at the top.

Parts

Refl. E-40, E-100 or E-200	Lamps 25, 40 or 100 watt
Refl. Holder and Supports	Wire Shade Frame
Diffusing Disk (white)	

Class C Installations

FLOOR OUTLETS

Indirect Lighting from floor outlets has been applied where novel lighting effects are desired. The pedestal urn used in the Hotel Pontchartrain, Grill Room, is centrally located, and to all intents and pur-

poses is merely a decorative receptacle for flowers and ferns. Pedestals also find great favor where the ceiling is low, as, for instance, the Hub, mezzanine floor.



Hyde Park Hotel W. L. Stebbins, Architect

Portable Floor Lamps

Hyde Park Tea Room

Size 23' 0" x 56' 0"	Ceiling 12' 0"
Number of Portables 8	Lamps per fixture 1-150 watt
Type of Reflector E-255	Top of reflector to ceiling 6' 0"



Pedestal used in the Hotel Pontchartrain, Detroit, Mich., Geo. D. Mason, Architect



Residence Stair Hall

Newell Post Lighting

Residence Hall

Size 9' 0" x 11' 0"	Ceiling height 9' 0"
Number of fixtures 1	Lamps per fixture 1-100 watt
Type of reflector E-200	Top of reflector to ceiling 30"



Residence Library

Portable Table Lamps

Residence Library

Size 16' 0" x 15' 0"	Ceiling 9' 6"
Number of portables 1	Lamps per fixture 1-150 watt
Type of reflector E-255	Top of refl. to ceiling 3' 6"



The Hub, Mezzanine Floor, Chicago, Ill.
Marshall & Fox, Architects

Balcony Pedestal Lighting

The Hub, Mezzanine Floor

Width 12' 0"	Ceiling 9' 6"
Pedestals on centers 10' 0"	Lamps per fixture 1-150 watt
Type of reflector E-250	Top of refl. to ceiling 30"

Class C Installations—Floor Outlets

BANK PARTITION LIGHTING

Capital State Savings Bank

This bank is illuminated by means of the indirect units located in the boxes as indicated on the plan and section, and the auxiliary lamps and reflectors placed above the skylights. These lamps are spaced so that the skylight is uniformly illuminated, giving the same effect as with indirect lighting.

Strictly speaking, banks come under Class A installations, but the treatment of this bank is of such a special nature that the logical place to discuss it is under Class C. The resultant illumination in this case, however, is fully as diffuse and uniform as required for Class A installations.

Illumination Calculations

Banking Space

(1) Spacing and Number of Fixtures.

Size of room 32' 0" x 50' 0" Ceiling 26' 0"

Total Fixtures

Boxes over cages 8

Boxes over entrance 4

Reflectors over skylight 16

(2) Wattage Required.

(Table 4, Page 14).

$2.0 \times 1600 = 3200$ watts.

(3) Number of Lamps per Fixture.

Boxes over cages 2-100 watt.

Boxes over entrance 1-150 watt.

Over skylight 1-60 watt.

(4) Type of Reflector.

(Table 1 and Chart 1).

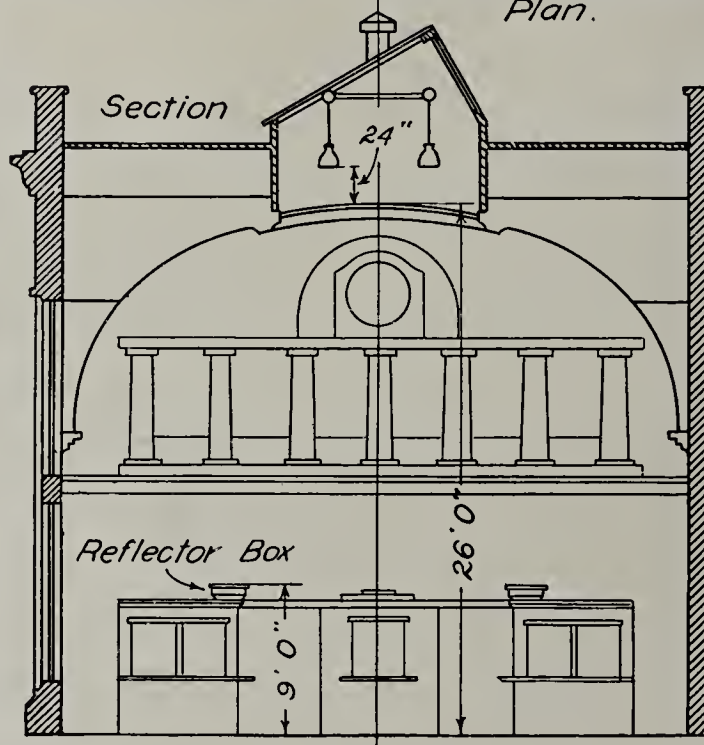
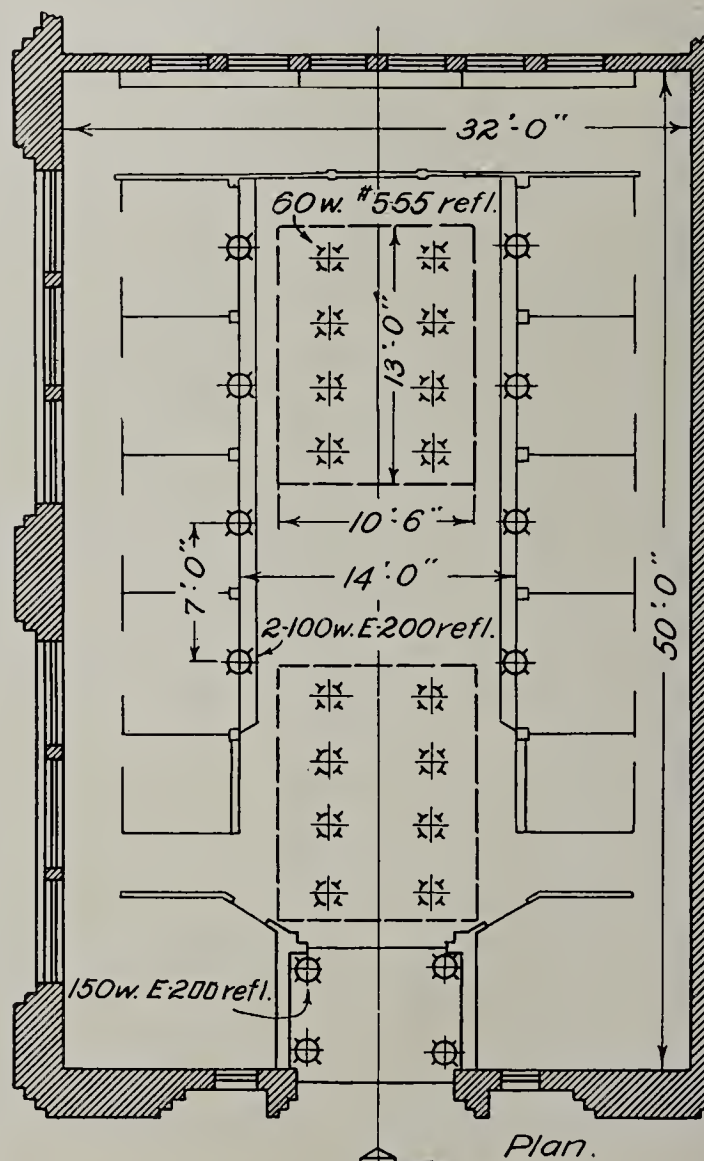
Boxes over cages E-100.

Boxes over entrance E-200.

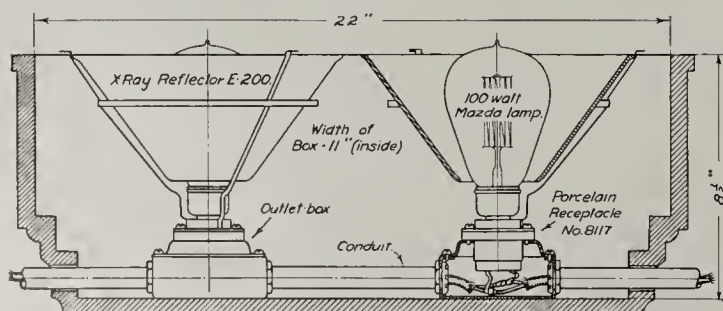
Over skylight No. 555.



Capital State Savings Bank, Chicago
Ottenheimer, Stern & Reichert, Architects



As will be noted, the boxes for the reception of the indirect reflectors are built up as part of the grill of the bank cages. The method of installing these reflectors is shown in detail. The porcelain receptacle (see Plate 12 for complete information) has pig-tail terminals for use with approved conduit work.



Detail of Reflector Box

Class C Installations—Cornice and Bracket Outlets

CORNICE LIGHTING

(See Plates Nos. 4, 12, 13.)

Indirect Lighting from cornices is the oldest form of lighting from *concealed sources*. It was applied to large interiors, in numerous instances, in the early days of the incandescent lamp, and there is record of its use, many years ago, with gas and even oil lamps.

It was conceded to give excellent lighting results, and to be the ideal method of displaying the architecture of an interior as a harmonious whole, but the waste of light was enormous, making such installations very expensive luxuries. With the advent of the modern high efficiency incandescent lamps, new possibilities were

opened up for illuminating interiors by this method.

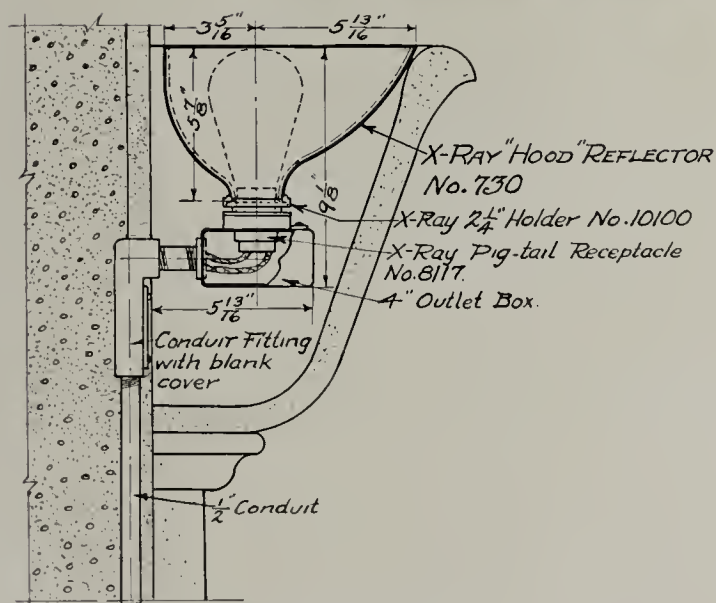
The X-RAY line of reflectors has been developed and extended so as to include the diversified conditions encountered, from the extremely high Gothic arched ceiling, to the low basket handle arch, and even the flat ceiling. (See Plates 4, 12, 13 and page 20).

The efficiency of cornice installations now compares very favorably with installations using ceiling fixtures. Many architects are using it in churches and auditoriums where the addition of a cornice is in perfect harmony with the style of architecture.

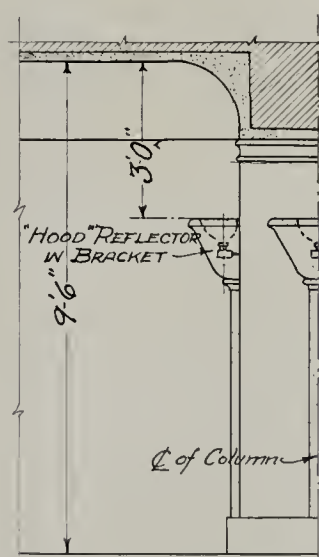
BRACKET LIGHTING



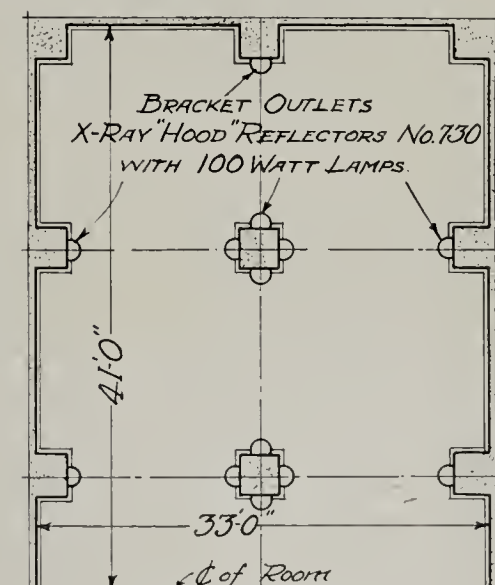
Teco Inn, Hotel Radisson, Minneapolis, Minn.



DETAIL OF BRACKET
SHOWING "HOOD" REFLECTOR IN PLACE



HALF COLUMN DETAIL
SHOWING BRACKETS IN PLACE



HALF PLAN

Indirect lighting, from brackets and walls is meeting with considerable favor, particularly in interiors with comparatively low ceilings. Its chief advantage lies in the fact that it leaves the ceiling clear, and gives the in-

terior a more "roomy" appearance. The indirect lighting tends to "raise the ceiling" which is most desirable in low rooms. It adds a subtle charm not obtainable with ceiling fixtures.

Class C Installations—Bracket Outlets

BRACKET LIGHTING

(Continued)

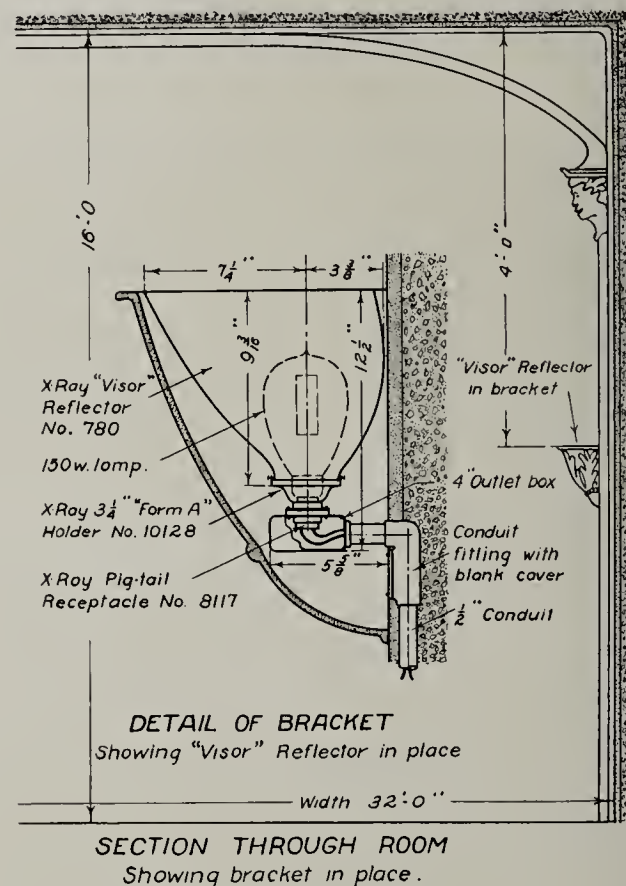


McLaughlin Cafe, Milwaukee, Wis.

McLaughlin Cafe

Installation Data

Size 84' 0" x 32' 0"	Ceiling 16' 0"
Number of brackets 18	Lamps per bracket 1-150 watt
Type of reflector Visor	Top of refl. to ceiling 4' 0"



INDIRECT CANDELABRA BRACKETS

In many interiors, especially, residences, hotels and clubs, etc., it is desirable to add a touch of refinement and cheerfulness, by the use of ornamental and decorative indirect candelabra brackets.

Since their function is chiefly ornamental it is advisable to use small size lamps. The brackets illustrated are designed for use with 10 or 15-watt tungsten lamps.

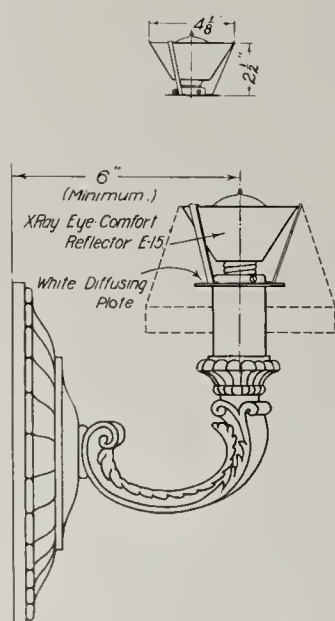


Fig. 1

The small adapter illustrated in figure 1 is very similar to the Curtis adapters for indirect art lamps.



Fig. 2



Fig. 3

The silk shade indicated by the dotted lines in Fig. 1 is softly illuminated by the small amount of light which comes through the opening in the bottom of the reflector. This light is reflected against the inner surface of the shade by the white diffusing plate.

The direct light candelabra bracket may be converted into an indirect bracket by simply adding the small adapter, as shown in figure 2 and the miniature silk shades, figure 3.

By the use of this same small reflector, or one of the larger ones, wall brackets may be designed of metal or compone, which resemble the ancient Flambeau in appearance.

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Patten Gymnasium
Northwestern University
Evanston, Ill.
Geo. W. Maher - Architect
Chicago



Max Lau Colortype Co.
Chicago
S.N. Crowen - Architect



Ford Motor Co. - Chicago
John Graham - Architect
Seattle, Wash.



First M.E. Church
Evanston, Ill.
Tallmadge & Watson
Architects
Chicago

187th Street Sub Station
United Electric Light & Power Co
New York City



Havana-American Tobacco Co.
Chicago
Geo. C. Nimmons - Architect

X-RAY DIRECT LIGHTING

The principle of concealed lamps and diminished glare is correct, whether the lighting is by direct or indirect methods. This principle is carried out in the X-RAY reflector equipment for direct lighting. The reflector is designed to practically hide from view the brilliant filament of the lamp.

Whether the reflectors are placed near the work or suspended on the ceiling above, the same protection to the eye is afforded.

Generally speaking, for commercial and industrial purposes two classes of direct lighting are resorted to, the *general system* and the *localized system*. In the one case the lamps are mounted at or near the ceiling, giving a uniform lighting throughout the room; in the other case, individual lamps on drop cords or brackets cause a strong light to fall upon the work leaving the rest of the room in comparative darkness. Since there are few instances in which local lighting is necessary, the general over-head system will fulfill economically most of the requirements of good lighting.

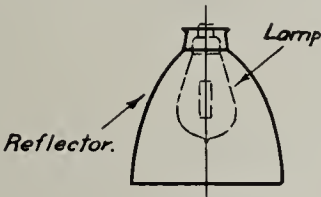
Of the many advantages of the over-head system, the following are probably the most manifest:

It makes available for working purposes every square foot of floor space.

It insures against accident, because there are no dark corners or dense shadows.

It gives a cheerful appearance to the room, since the whole area is uniformly lighted.

The room with the absence of drop cords presents a very clean-cut appearance, and in many cases permits an unobstructed view from one end of the room to the other.



A marked advantage of the X-RAY reflector from the standpoint of up-keep, is the ease with which it may be cleaned. The fire-glazed finish allows the dust to be easily removed by merely wiping out the inside surface of the reflector with a dry cloth.

All X-RAY reflectors are carefully designed to hide the lamp and to control and direct the light at the most useful angles.

The X-RAY reflectors available for direct lighting in commercial and industrial buildings, are illustrated on this page.

Table 17. X-Ray Reflectors
Classified According to Lamp Size and Light Distribution

Refl. No.	Dia.	Height	Holder	Type of Refl.	Lamp Size-Watts
555	6 3/8"	5 1/8"	O-2 1/4"	Distributing	25-40-60
565	7 1/2"	7 1/8"	H-2 1/4"	Distributing	100
696	8"	5"	O-2 1/4"	Concentrating	25-40-60
700	10"	5 1/2"	H-2 1/4"	Semi-Concen.	100
710	11 1/2"	6 3/4"	O-2 1/4"	Concentrating	100
765	10 1/2"	11 1/8"	A-3 1/4"	Distributing	150-250

Specifications
Direct Lighting Fixtures

NOTE:—The following is a sample specification for direct lighting fixtures:

Fixtures.

All fixtures must be constructed of the material and finished as specified in the accompanying schedule of fixtures. Each fixture must be equipped with the type of X-RAY reflector, and shade holder specified, and must be constructed in accordance with all rules and requirements of the National Board of Fire Underwriters.

Reflectors.

The reflectors to be furnished must be X-RAY one-piece tough blown silvered glass reflectors of the types and sizes specified.

Holders.

The reflector holders to be furnished must be the type and size specified, and must be of standard dimensions approved by the architect.



No. 765, The Beehive No. 565 No. 555

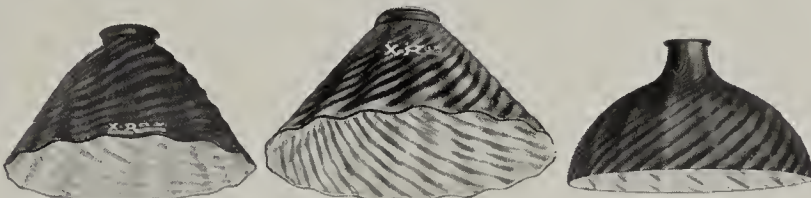
Reflectors

The X-RAY direct lighting reflectors are especially designed to fulfill the requirements of good lighting. They are of one-piece tough blown silvered glass. They have a wide adaptability and can be used in practically all places where indoor direct lighting is required. Their special points of advantage are:

- Highest known efficiency,
- Permanency,
- Ease of maintenance,
- Scientific design.

Because these are the most efficient reflectors available, the highest economy in supplying illumination may be obtained by their use.

A remarkable feature of the X-RAY reflector is, that it retains its original brightness and efficiency indefinitely. This results from the special processes that are used in the manufacture of these reflectors.



No. 696 No. 700 No. 710

Schedule of Fixtures
Direct Lighting

ROOM	Ceiling Height Feet	FIXTURE					
		No. Req'd.	Type No.	Finish	Lamp Watts	Refl.	Length of Suspension * *
Mach. Shop.	15	20	21	Zinc Plated	100	565	36"

All lamps specified must be clear bulb tungsten having a voltage rating corresponding to the voltage of the circuit on which they are to be used.

**The length of suspension is the distance from the bottom of the reflector to the ceiling.

DIRECT LIGHTING FIXTURES

Direct lighting fixtures embodying X-RAY reflectors may be made up in pleasing and ornamental designs in conformity with the architectural features of the interior. In such interiors as stores and display rooms, churches, assembly halls, etc., it is often desirable to install attractive fixtures.

The decorative fixture No. 14 of spun brass, covers the BEEHIVE reflector No. 765. This fixture is 11½" in diameter, 16" high and can be used to advantage in store lighting. (See Page 42).



No. 14



No. 13

The design No. 13 also incases the BEEHIVE reflector, and is constructed of leaded art glass with wood rim and socket block. A glass bottom or diffusing plate can be placed in the lower rim of the fixture. Size: 14½" diameter and 16½" high.

The application of lantern No. 15 is shown on Plate No. 23. This gothic design is especially suitable for church lighting. It is 36" in diameter and is constructed to accommodate three No. 765 X-RAY reflectors, in addition to three small lamps for the illumination of the glass sides and bottom.



No. 15

The types in wood, art glass and metal here illustrated, suggest the unlimited possibilities in the design of direct lighting fixtures for interiors which are not adapted to indirect lighting, but in which it is highly important to apply the principle of *lighting from concealed sources*.



No. 18

A box type fixture like No. 18 with reflector No. 696, is easily installed at the ceiling in stores, under balconies, etc. This box is 10¾" x 10¾" and 8" deep.

A SINGLE UNIT CEILING FIXTURE Inexpensive, Flexible, Easily Installed

An excellent type of canopy fixture which can be used with any of the X-RAY direct lighting reflectors, is here illustrated. The unit is arranged with a strap for attaching to the lugs of a standard outlet box or to a fixture stud and is especially desirable for installations in shops, factories, workrooms, stores, garages, printing plants, power plants, kitchens, laundries, etc. It is approved and can be used without an insulating joint.



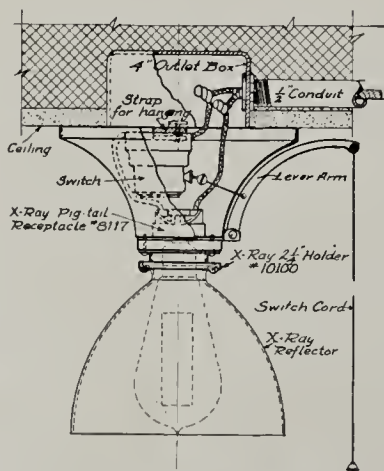
Complete Fixture with
No. 555 X-Ray
Reflector

Switch Attachment

A unique and very desirable feature of this fixture is the switch and lever arm attachment which enables the individual unit to be controlled independently of the other units on the circuit. The fixture can be obtained with or without the switch attachment.

Parts Interchangeable

The interchangeability of parts makes it possible to use with the fixture any of the types of holders shown, thus covering all ordinary requirements as to lamp size, style of reflector, and height of suspension.



Sketch indicating the method of
installing the fixture

Part No. 10100 is a Form "O"—2¼" shade holder.

No. 10127 shows the Form "H"—2¼" shade holder.

No. 10128 is a Form "A"—3¼" shade holder.

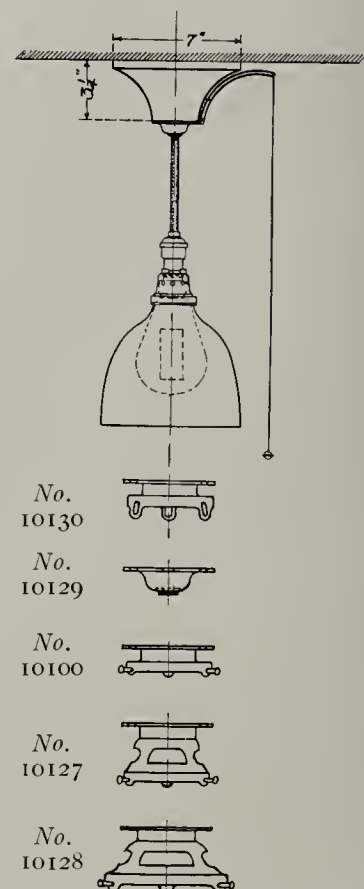
These holders conform with the standards given on page 37 and are to be used as suggested in table No. 17, Page 35.

When it is desired to suspend the reflector down a distance from the ceiling, the cap No. 10129, with center bushed opening is used in place of the holders described above. In this case receptacle No. 8117 is not used. The reflector is attached by a standard shade holder to a brass shell socket at the end of the drop cord.

Attachment No. 10130 can be employed in suspending EYE COMFORT Lighting fixtures. The slotted holes in this fitting take the chains which support the bowl of the fixture.

Finishes

The fixture can be given a variety of finishes. For factory installations a zinc plate or sheradized finish is satisfactory. For stores, kitchens, etc., the unit will present a good appearance finished in aluminum bronze.



No.
10130

No.
10129

No.
10100

No.
10127

No.
10128

PLANNING THE LIGHTING EQUIPMENT

Shade Holders

To avoid trouble in installing reflectors, and to insure that the lamp is held in the proper position in the reflector, follow the suggestions given below.

X-RAY reflectors are made with necks of standard sizes. Regular stock shade holders can be used. The types mentioned will fit the various kinds of brass shell sockets and conduit fittings, and are carried by electrical dealers and jobbers.

Where porcelain receptacles are used, care should be taken to procure porcelains with the shade holder groove.

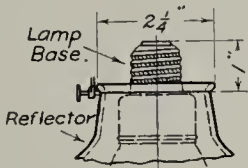


Fig. 1—"O"—2 1/4"

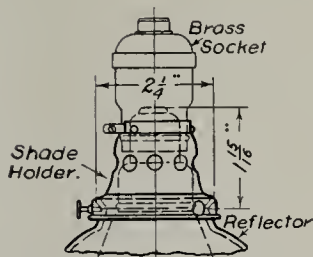


Fig. 2—"H"—2 1/4"

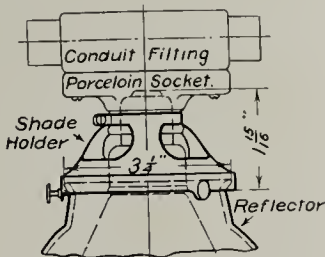


Fig. 3—"A"—3 1/4"

Shade Holder Positions

The correct relations of reflector and shade holder are shown by these figures.

Note that Form "O," 2 1/4" is a low or flat holder maintaining a dimension of about 1" from center of shade holder screws to the point of contact of the lamp base. Form "H," 2 1/4" and form "A," 3 1/4" are deeper holders, maintaining a corresponding dimension of about 1 1/8".

Figures 2 and 3 show the adaptation of holders to brass shell and porcelain sockets respectively.

The holders listed below meet the adopted standards for X-RAY reflectors for Direct and Show Window lighting.

When Form "O" Holder is required

- For Brass shell sockets, the following may be used:
Hubbell 2 1/4" No. 5339.
Holophane 2 1/4" "O".
Bryant, 2 1/4" No. 440.
- For Porcelain sockets, used with Condulets, Unilets, etc.:
Appleton 2 1/4" No. 7321.
Crouse-Hinds 2 1/4" No. NRS.
- Pass & Seymour, 2 1/4" No. 28.
Plume & Atwood, 2 1/4" No. 1264.

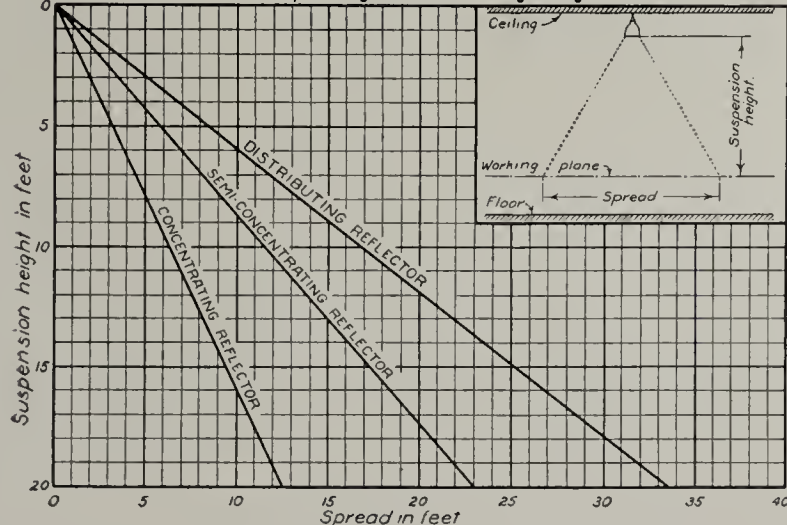
When Form "H" Holder is required

- For Brass shell sockets, the following may be used:
Bryant 2 1/4" No. 441.
Plume & Atwood 2 1/4" No. 2525.
- For Porcelain sockets, used with Condulets, Unilets, etc.:
Appleton 2 1/4" No. 7322.
Crouse-Hinds 2 1/4" NRH.
- Holophane 2 1/4" "H".

When Form "A" Holder is required

- For Brass shell sockets, use:
Holophane 3 1/4" "A".
- For Porcelain sockets, used with Condulets, Unilets, etc.:
Appleton 3 1/4" No. 7323.

Chart No. 2- Spacing of Direct-Lighting Units.



Illumination Calculations

A simple method of calculating illumination with X-RAY direct lighting reflectors is as follows:

Selection of Unit Area

Select a typical bay or area which may be considered as the unit area for purposes of lighting calculations. This area in most cases will be one of the squares into which the building is naturally divided architecturally by columns, posts, ceiling beams, etc.

Wattage Required

The amount of wattage required to properly illuminate this area will depend upon the character of work done under the light, or the use to which the room or building is to be put.

The values of watts per square foot for various classes of service, are to be found in Table 18. By multiplying these values by the number of square feet in the unit area, a total wattage for that area may be derived.

Number of Lamps

This value of total wattage determines the number of lamps of any given size to be used for the unit area.

Spacing of Units

The spacing and height of suspension of the lighting units will depend upon the degree of diffusion and uniformity of illumination desired. The closer the units are together the less intense will be the shadows and the more uniform will be the lighting result.

Hanging Height

Chart No. 2 at the bottom of the page shows, for various suspension heights, the maximum size of square which can be uniformly illuminated from a single lighting unit.

It is seen from Chart No. 2 that for distributing reflectors the lamps should be spaced about 1.5 times the height at which they are suspended above the plane of illumination. For typical examples of spacing and hanging refer to plates Nos. 20, 21 and 24 and to pages 38, 39, 40 and 41.

Selection of Reflector

The selection of the proper reflector for a given condition is governed largely by the size of the area over which the light is to be distributed by each lamp and reflector. If this area is comparatively large as in cases where general illumination is required the distributing or BEEHIVE types of reflectors should be used. When the area to be lighted is small and requires a strong illumination the concentrating reflectors are best adapted.

A Typical Example

A system of overhead general illumination is desired for a factory (Calumet Baking Powder Co., Plate No. 24) which has bays 16' 0 3/8" x 19' 5 1/2" and a ceiling height of 12' 2". Considering this bay as the unit area, then

Floor area 16' 0 3/8" x 19' 5 1/2"=312 sq. ft.
Watts per sq. ft. required (for general illumination only) (See table 18)=.3.
Total watts=.3 x 312=94 watts.
The total wattage of 94 nearly equals 100 watts.

Hence one 100-watt lamp at the ceiling per bay will be sufficient for this installation.

From Chart No. 2 for a height of 12' we obtain 20' as the size of a square that can be illuminated from the center outlet. This practically conforms with the size of the bays under consideration.

Since general illumination is required use a distributing reflector. From Table 17, No. 565 is the proper type of reflector for the lamp selected.

Table 18. Watts per Sq. Ft.

Armory, Auditorium or Exhibition Building	.35— .45	Operating Table	1.75—2.25
Art Gallery walls	.85— .95	Pattern Shop	.50— .60
Auto Show-room	.85— .95	Power House	.40— .50
Billiard Tables (See Page 44)		Press Room	.70— .80
Bowling Alley (See Page 44)		Residence	
Car Barns	.25— .35	Pantry and Kitchen	.35— .45
Carpenter Shop	.45— .60	Laundry	.25— .35
Church, (Dark Ceilings)	.35— .45	Furnace room and store room	.10— .20
Dance Hall	.35— .45	Restaurant	.35— .45
Engraving Room	1.60—1.80	Rug Rack, (See Page 42)	
Factory		Sewing, Light Goods	.65— .75
General work with drop lights	.25— .35	Sewing, Dark Goods	1.30—1.50
Machine Work no drop lights	.65— .75	Skating Rink	.35— .45
Machine Work, fine work	.65— .75	Stable	.15— .20
Bench Work localized	.65— .75	Stock Room	.15— .20
Foundry	.50— .60	Stores	.60—1.00
Freight House	.25— .35	Swimming Pool	.45— .55
Garage	.35— .45	Telephone Exchange	.55— .65
Gymnasium	.45— .55	Train Shed	.15— .20
Laundry	.35— .45	Type Setting	1.30—1.50
Machine Shop (See Factory)		Warehouse	.25— .30
		Weaving	.85— .95

SHOPS, FACTORIES AND WORKROOMS

(See Plate Nos. 20, 21, 24).

Light is a tool that is designed for the workmen; it is a safety appliance, a guard against accident; it enables the worker to perform his work more easily and more efficiently; it influences the economy of production.

The methods used for the lighting of factories and industrial buildings have been practically revolutionized during the last few years. The old drop cord system giving an intense light in one spot has been discarded for other arrangements which produce uniform lighting in all parts of the room.

The use of moderate size units, arranged to provide a uniform intensity over the entire area is desired, and is preferable to a smaller number of high candle power units placed at greater distances apart.

Distributing types of reflectors are best adapted for factory illumination, and will cover practically all conditions.

In planning the illumination for factories and in selecting the lighting equipment the following principles should be kept in mind:



Portion of Machine Shop, National X-Ray Reflector Co., Chicago
Francis M. Barton, Architect

- (1) Protect the eyes by placing the lighting units high above the work and by hiding the lamps.
- (2) Provide plenty of light for the class of work that is to be done.
- (3) See that light is given the proper direction for the purpose of the workman.
- (4) Distribute the units to obtain as nearly uniform illumination as possible.



Western Clock Co., La Salle, Ill.



Pattern Shop, Berlin Machine Works, Beloit, Wis.
Perkins, Fellows & Hamilton, Architects, Chicago, Ill.

Berlin Machine Works

Pattern Shop

Size 50' 0" x 116' 0"	Ceiling 13' 0"
Number of fixtures 50	Lamps per fixture 1-100 watt
Type of reflector No. 765	Bottom of refl. to floor 12' 0"
Watts per sq. ft. 1.0	Reflector centers 10' 0"

National X-Ray Reflector Co.

Portion of Machine Shop

Typical bay 16' 0" x 16' 0"	Ceiling 13' 0"
Number of fixtures 2	Lamps per fixture 1-100 watt
Type of reflector No. 765	Bottom of reflector to floor 12' 0"
Watts per sq. ft. 0.78	

Western Clock Company

See Partial Plan at bottom of Page

Typical bay 20' x 40'	Lamps per fixture 1-150 watt
Number of fixtures 3	Watts per sq. ft. 0.56
Type of reflector No. 765	Bottom of refl. to floor 13' 0"



Western Clock Co., La Salle, Ill. (Day Photograph)

PRINTING SHOPS

The average printing plant is divided into a number of practically independent areas where special kinds of work are being done, and each of those areas require individual attention when the lighting is being planned.



Type Setting Department, Butler Bros., Chicago, Ill.
D. H. Burnham & Co., Architects

Typesetting, hand composition and proof reading are probably the most difficult operations in the printing plant and require a strong, well shaded light. A local general system like that shown for Butler Bros., is best for these departments.

A more general illumination can be provided for the press room, although the feed end of the press must have a strong light.

Imposing stones require an intensity as great as that provided for typesetting. A 100-watt lamp in a concentrating reflector over the center of the stone is found to be very satisfactory.

In addition to general illumination for Linotype machines, it is necessary that a local light be used at the keyboard.

For small machines such as saws, paper cutters, casting machines, etc., good general lighting is all that is required.



Color Press Department, Sears Roebuck & Co., Chicago, Ill.
Geo. C. Nimmons, Architect

The wattage required, the type of reflector, and its hanging height, must be determined for each individual outlet, keeping in mind the nature of the work that is to be done under the artificial light.



Job Printing and Composing—Saul Bros., Chicago, Ill.
Borland Mfg. Bldg., Chas. S. Frost, Architect

Butler Bros.

Type Setting Department

Reflectors are arranged in rows over the type cases. A strong illumination is required for the special conditions found here.

Typical bay 21' 6" x 16' 6"	Ceiling 14' 0"
Number of fixtures 6	Lamps per fixture 1-100 watt
Type of reflector No. 765	Bottom of refl. to floor 10' 0"
Watts per sq. ft. 1.7	Refl. centers 6' 0" and 7' 0"

Sears Roebuck & Co.

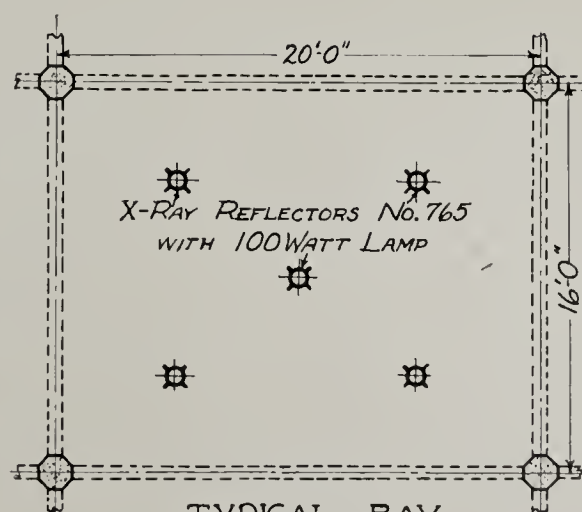
Color Press Department

Typical bay 16' 0" x 20'	Ceiling 16' 0"
Number of fixtures 5	Lamps per fixture 1-100 watt
Type of reflector No. 765	Bottom of reflector to floor 12' 0"
Watts per sq. ft. 1.55	

Saul Bros.

Printing and Composing Room

Typical bay 15' 0" x 30' 0"	Ceiling 11' 6"
Number of fixtures 6	Lamps per fixture 1-60 watt
Type of reflector No. 700	Bottom of reflector to floor 10' 8"
Watts per sq. ft. 0.8	



TYPICAL BAY

Sears Roebuck & Co.

GYMNASIUMS AND SWIMMING POOLS

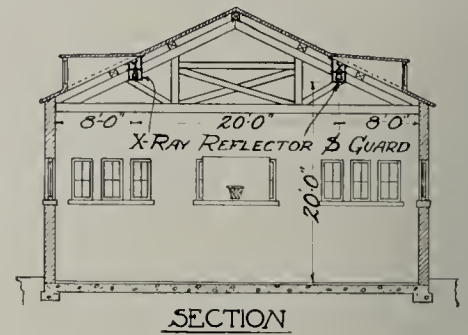
(See Plate No. 22)

Gymnasium Lighting

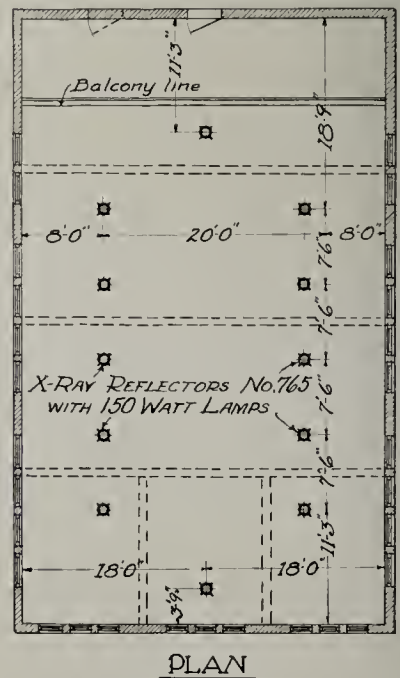
Gymnasium activities are largely carried on by artificial illumination, especially in the Y. M. C. A., and playground park gymnasiums of the large cities. The benefits of the exercise will therefore be directly proportional to the satisfactory character of the lighting system employed. The example given shows good gymnasium lighting. The general arrangements of the lighting units are given in the figures.

Holstein Gymnasium

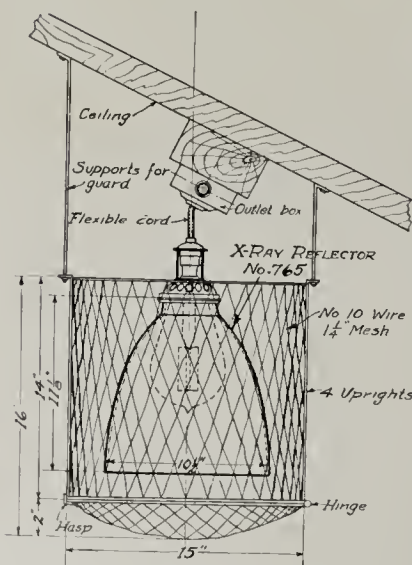
Size 36' 0" x 60' 0" Ceiling 28' 0"
 Number of fixtures 12 Lamps per fixture 1-150 watt
 Type of reflector No. 765 Bottom of reflector to floor 20' 0"
 Watts per sq. ft. 0.83



Gymnasium, Holstein Park, Chicago, Ill.
 Henry Sierks, Architect



Gymnasium, Holstein Park



The Lighting Unit

Reflector with Protecting Wire Guard

The reflectors should be protected by wire guards, against damage by balls and swinging apparatus. Guards do not affect the lighting results. The fastening of the protectors should be independent of the reflector equipment as shown in the sketch.



Swimming Pool, Northwestern University, Evanston, Ill.
 Geo. W. Maher, Architect, Chicago

Room size 44' 0" x 71' 0" Ceiling 16' 0"
 Number of fixtures 12 Lamps per fixture 1-100 watt
 Type of reflector No. 765 Bottom of reflector to floor 13' 0"

The swimming pool is 25' x 60'. The ceiling under the balcony is 8' high. Small auxiliary lamps are used to light the glass panels of the fixtures.

GARAGES AND POWER PLANTS



Garage, Toronto, Ontario

Garages

The small private garage for one car, as well as the large commercial garage, needs a carefully planned lighting system. Much of the inconvenience, delay and danger in making repairs can be eliminated by providing plenty of well diffused light in the garage.

See Plate No. 20 for detailed information regarding the lighting of service stations and commercial garages.

The illustration shows a garage in Toronto Canada lighted by BEEHIVE reflectors with 150-watt lamps.

Size 70' 0" x 90' 0"

Ceiling 15' 0"

Number of reflectors 18

Type of reflector No. 765

Lamps per fixture 1-150 watt

Bottom of reflector to floor 13' 0"

Power Plants and Pumping Stations

It is necessary in power plants, pumping stations, etc., to provide illumination of good working intensity and to eliminate to as great a degree as possible, shadows on switch boards, gears, bearings, moving and adjustable parts, etc. It is also of high importance that the plant should never be left in darkness, hence an alternate or emergency lighting system is sometimes installed.

The most satisfactory results are obtained with the lamps and reflectors placed well overhead as shown by the two cases illustrated. The whole floor area is then uniformly lighted.



*Pump Room, Curtis Publishing Co., Philadelphia, Pa.
Edgar V. Seeler, Architect*

United Electric Light & Power Co.

Transformer and Rotary Room



Transformer and Rotary Room. United Electric Light & Power Co., New York City

This room has an alternate lighting system consisting of 5-500 watt EYE COMFORT fixtures which hang 42" from the ceiling. This system is entirely independent of the direct lighting circuit.

Size 89' 0" x 26' 6"

Ceiling 31' 0"

Number of fixtures 20

Type of reflector No. 765

Lamps per fixture 1-100 watt

Watts per sq. ft. .85

Bottom of reflector to floor 28' 0"

Curtis Publishing Company

Pump Room

Typical bay 20' 0" x 20' 0"

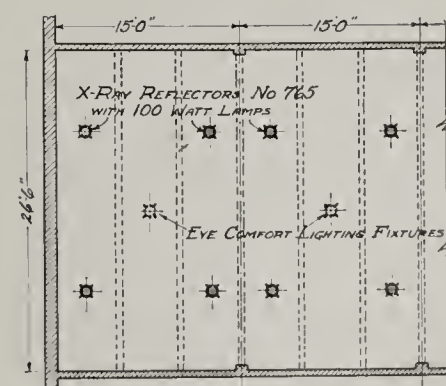
Ceiling 20' 0"

Number of fixtures 1

Type of reflector No. 765

Lamps per fixture 1-150 watt

Bottom of reflector to floor 18' 0"



*Partial Plan
United Electric Light & Power Co.*

STORES AND QUOTATION BOARDS

Stores and Display Rooms

In a number of stores, conditions are unfavorable to the use of the Eye Comfort Lighting System. The ceiling may be of a dark color, or heavily beamed, or broken up with skylights.

Again, there are display rooms where beauty of the interior is of no consequence. Hardware, Cutlery, Undertakers' supplies and sporting goods stores are typical. So long as the goods are displayed in a clear, even light, at a minimum current consumption, the requirements are satisfied.

The illustration shows the lighting effect that may be gained by using X-RAY direct lighting reflectors for store and display room lighting. The quality of illumination, intensity and uniformity are all that can be desired.

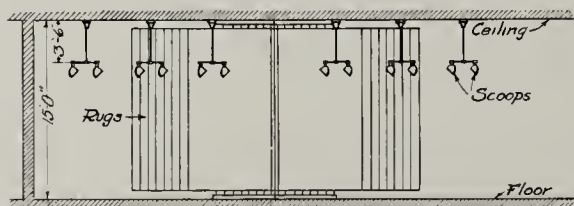
The use of the ornamental fixtures wherein the BEEHIVE reflectors are contained, adds greatly to the appearance of the installation. These fixtures are made just large enough to cover the X-RAY reflectors. (See Page 36.)



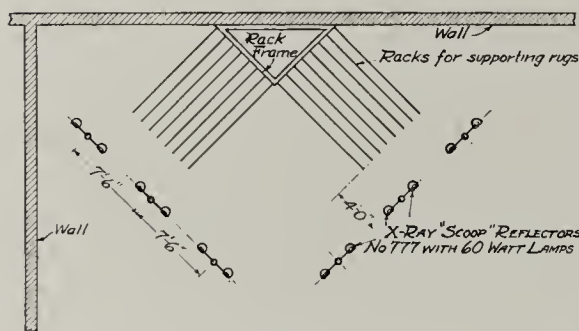
Display Room—National Casket Co., Philadelphia, Pa.

Size 80' 0" x 25' 0"
Number of fixtures 16
Type of reflector No. 765
Watts per sq. ft. .8

Ceiling 12' 0"
Lamps per fixture 1-100 watt
Bottom of reflector to floor 9' 6"



Showing open rug racks and position of reflectors.



PLAN

Rug and Carpet Displays

The diagram at the left shows a standard lighting arrangement for rug racks and carpet sample displays, and can be relied upon to give satisfactory results. X-RAY SCOOP reflectors are located 4' from the outer edge of the pivoted arms of the rack. Sixty watt lamps are recommended.

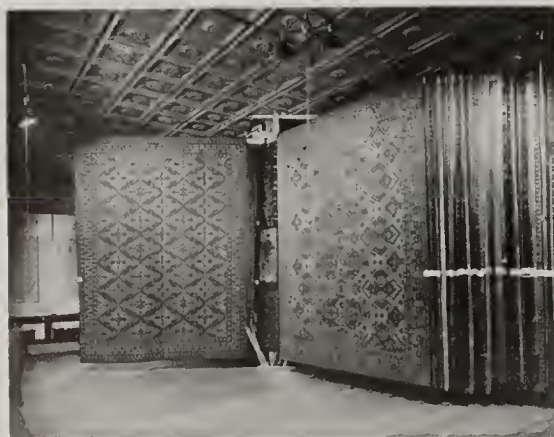
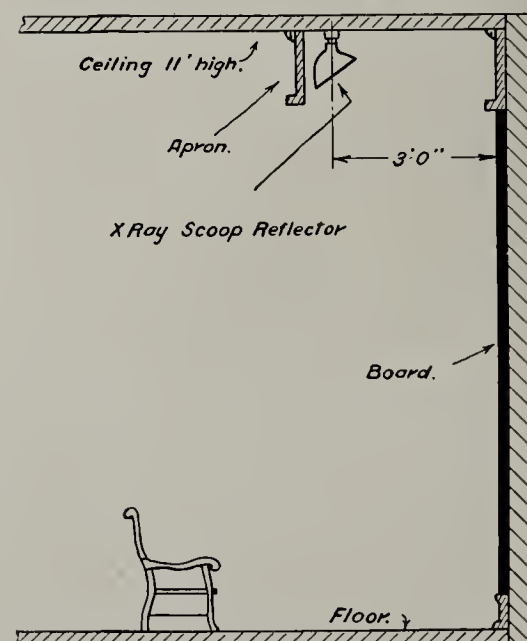
If the rack is circular the lighting units can also be arranged in a concentric circle. For cases in which the rack pivots extend in a row along the wall, the outlets should be placed parallel to the wall.

Stock Quotation Boards

An even illumination is required over the entire surface of the board, so that figures and quotations may be as easily seen at the bottom of the board as at the top. Again the intensity of illumination must be provided sufficient to enable the marks on the board to be seen in any part of the room. The question of concealing the lamps is often simplified by building a false beam or apron behind which the lighting equipment is placed. X-RAY SCOOPS are used with 60-watt lamps, about 2' apart.



Stock Quotation Board Lighted by "Scoops"
New York Life Bldg., Chicago, Ill.
Mundie & Jensen, Architects



Rug Display Rack—"Scoop" Reflectors are installed in accordance with above diagram

SKYLIGHT ILLUMINATION

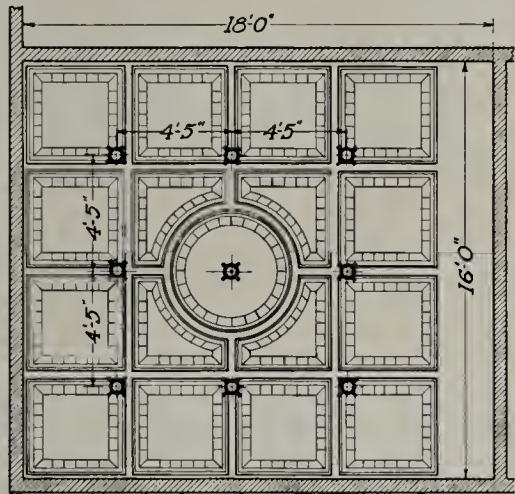
Skylight illumination is without doubt a most ideal method of lighting because of its perfect diffusion and softness. To be satisfactory this method must employ reflectors of highest efficiency. These reflectors must be correctly designed to spread the light evenly over the glass. Skylight illumination is especially adapted for art galleries, schoolrooms, churches, lobbies, etc. See page 14 for bank illuminated partially by skylight.

Central Trust Company
Private Office
Size 16' 0" x 18' 0"
Ceiling 12' 0"
Number of fixtures 9
Type of reflector No. 765
Lamps per fixture 1-150 watt
Watts per sq. ft. 4.7
Distance reflector above skylight 32"
Reflector centers 4' 5"

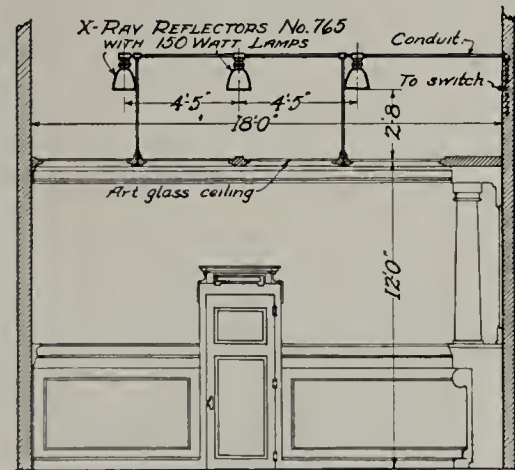
The room is finished in dark mahogany, walls dark green, ceiling is of art glass of green, amber and brown patterns. Comparatively large wattage per square foot is used, because of extremely dark conditions.



Private Office, Central Trust Co., of Illinois, Chicago
Mundie & Jensen, Architects



Plan of Skylight, showing location of lighting units



Section Central Trust Co.

Hospital Operating Rooms with Skylights

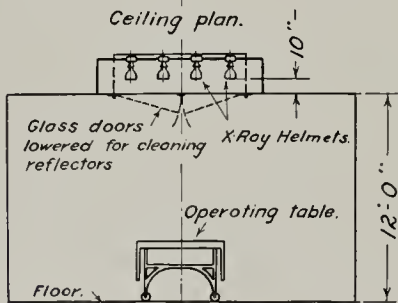
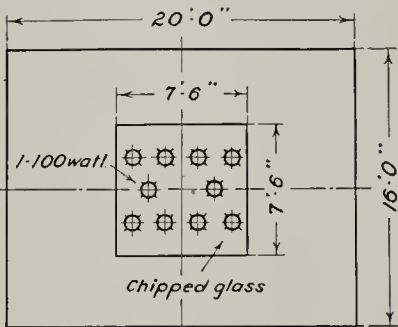
An excellent system of diffuse illumination for hospital operating rooms is in use in the Southern Pacific Hospital of San Francisco. The small plan and section of the room show a battery of ten X-RAY HELMET reflectors suspended above a chipped glass ceiling. The wattage per square foot is 3.13, which gives the required intense illumination for operations. On page 16 is described the lighting of operating rooms by the EYE COMFORT system.

Glass

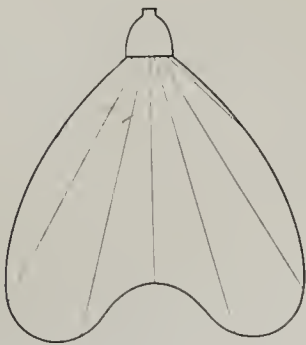
A consideration of the character of the glass employed for skylights is of the highest importance, because of the loss that results from passing the light through this glass.

Below are given the value of watts per sq. ft. for office lighting, for various kinds of glass. Those low in absorption are best adapted for skylights. The samples mentioned are selected from the stock of Leo Popper & Sons.

Table 19. Watts per Sq. Ft. for Skylights			
Eupher Green	1.60	Alba-Illia	1.80
Fl. Yellow	1.75	Illuminal	1.65
Cathedral 300 LL	1.50	Deflex No. 1	1.50
Opalescent No. 6	1.50	Alba Sheet Glass	1.50



Southern Pacific Hospital
San Francisco



Curve showing best type of light distribution for skylight illumination.

POOL TABLES AND BOWLING ALLEYS



*Bowling Alley, Town Club, Milwaukee, Wis.
Howard Russell, Architect*



*Billiard Tables, Quinn & Co., Chicago, Ill.
Reflectors installed in accordance with the diagram below. No. 555
X-RAY reflectors on drop cords are used over card
tables in rear of room*

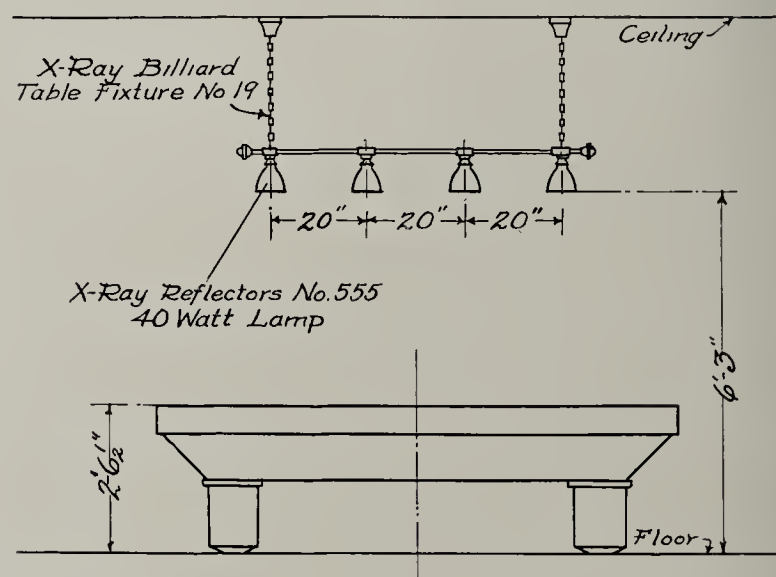
Billiard and Pool Tables

The arrangement for billiard and pool table lighting, as shown by the diagram to the right, indicates a method for obtaining practically ideal lighting for this class of service. The evenness of the illumination on the table is perfect, and the expenditure for wattage is low, since only four 40-watt lamps are required.

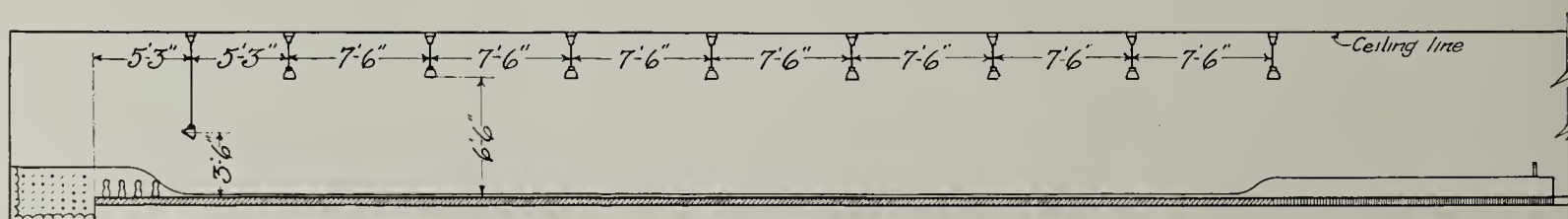
Bowling Alleys

In the lighting of bowling alleys the important requirements are to supply even illumination over the surface of the alley, and a strong light at the pins. It is very essential also to conceal the lamps from view. This scheme will eliminate alternate bright and dark spots which tend to give the alley a wavy appearance and are very annoying to the players.

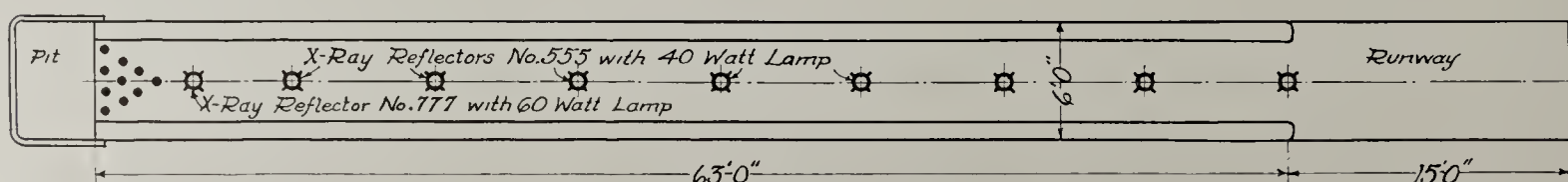
The plan and section below shows the location of lighting units for proper bowling alley illumination. The dimensions given are for a standard bowling alley. Eight X-RAY reflectors No. 555 with 40-watt lamps should be placed 6' 6" feet above the alley as indicated.



For the lighting of the pins a SCOOP reflector No. 777 with 60-watt lamp located 5' 3" from the edge of the pit and 3' 6" above the alley, will give excellent results.



SECTION



PLAN

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Chas. A. Stevens & Bros.
Chicago
D. H. Burnham & Co.
Architects



Jas. McCreery & Co.
New York City
Starrett & VanVleck
Architects

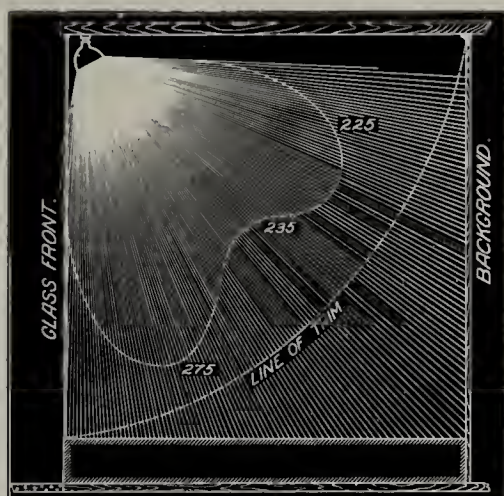


Miller Rhoades & Swartz
Norfolk, Va.
B. F. Mitchell
Architect

EQUIPMENT

(See Plate Nos. 16, 17, 18, 19)

Keen competition demands the use of efficient equipment. No mercantile establishment could exist, if the same ratio of waste, found to exist in the obsolete methods of show window illumination employed, were permitted in all departments.



Cross section of Class-A window showing distribution of light from Scoop with 60-watt lamp

X-RAY window reflectors are designed with these fundamental features as a basis. They hide the lamp, and direct the maximum light onto the goods. No light is wasted on the ceiling of the window or sidewalk.

The X-Ray line covers the field of show window lighting completely. Each individual reflector is perfectly suited to a certain class of windows. Hence it is vitally important that the proper reflectors always be used.

Scoop installed in window showing electrical fittings

The window display should be brightly illuminated.

The show window in reality is a stage setting; hence the method of illuminating it should be similar to the methods employed in stage lighting—a brilliant light directed from concealed sources.



Visor installed in window showing electrical fittings

Classification of Show Windows

CLASS A—Height equal to depth

High trim on background. Average dimensions: height 9', depth 9', height of trim 9'.

Windows of this class are usually trimmed up high on the background. The Scoop (No. 777) reflector, with 60-watt unskirted base tungsten lamp is designed for this class.



Cross section of Class-B window showing distribution of light from Visor with 100-watt lamp

CLASS B—Height $1\frac{1}{2}$ times depth

(1) Medium trim on the background. Average dimensions: height 10', depth 6', height of trim 7'.

(2) High trim on the background. Average dimensions: height 10', depth 6', height of trim 9'.

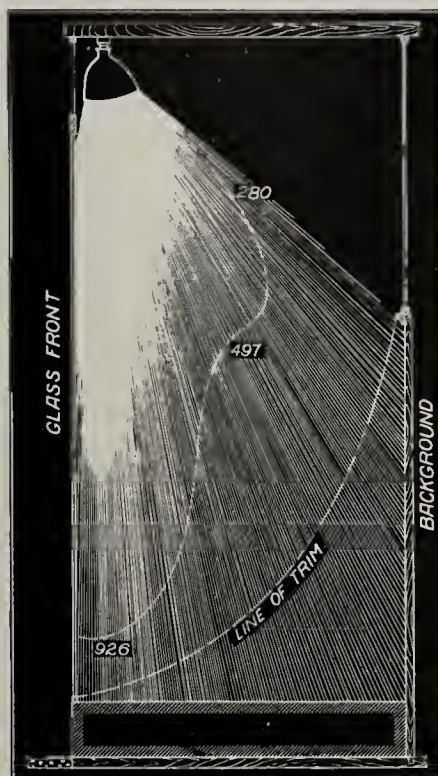


Helmet installed in window showing electrical fittings

Windows of this class are trimmed medium and high. The Visor (No. 780) reflector with 100-watt tungsten lamp is designed for medium trim, whereas, the Hood and Scoop reflectors alternated, are best suited to the high trim.

CLASS C—Height 2 times depth

Medium trim on background. Average dimensions: height 12', depth 6', height of trim 7'.



Cross section of Class-C window showing distribution of light from Helmet with 100-watt lamp

Windows of this class are usually trimmed to a medium height and are quite shallow. The Helmet (No. 755) reflector with 100-watt tungsten lamp is designed for this class.

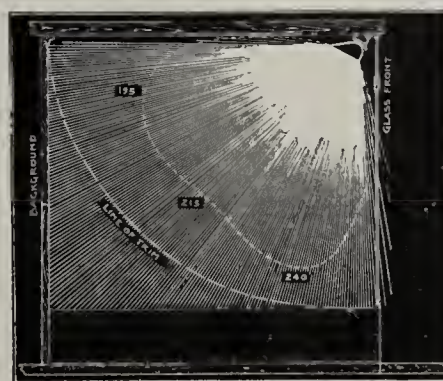


Poke Bonnet installed in window showing electrical fittings

CLASS D—Height equal to depth.

High trim on background. Average dimensions: height 5', depth 6', height of trim 5'.

Windows of this class are found chiefly where the show windows are divided into two tiers, and in shops with low headroom situated on the ground floor. The Poke Bonnet No. 750 reflector with 2-60 watt unskirted base tungsten lamps, is designed particularly for this class of windows. It is small and takes up little headroom.



Cross section of Class-D window showing distribution of light from Poke Bonnet with two 40-watt lamps

PLANNING THE LIGHTING EQUIPMENT

(See Plate No. 19)

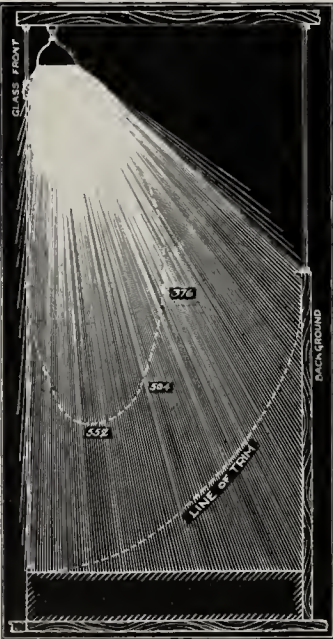


Hood installed in window showing electrical fittings

CLASS E—Height 2 Times Depth
Low trim on background.
Average dimensions: height 5', depth 2' 6", height of trim 2'.
Windows of this class are found largely in jewelry stores, cigar stores and shoe stores. The line of trim is low and frequently nearly flat. The Hood (No. 730) reflector with a 60-watt unskirted base lamp is designed for this class. The reflector hides the bright lamp filament from the observers on the street and in the store. This is a very desirable feature as many Class E-Windows are open, or glass above the solid background, (See Plate No. 19).

The height of the window is always measured from the floor to the ceiling; the depth from the glass front to the background; the trim from the floor up.

The accompanying diagram used in connection with Table 20, enables anyone easily to lay out an X-RAY window lighting installation. It shows the space occupied by the various reflectors at the top of the window.



Cross section of Class—E window showing distribution of light from Hood with 60-watt lamp.

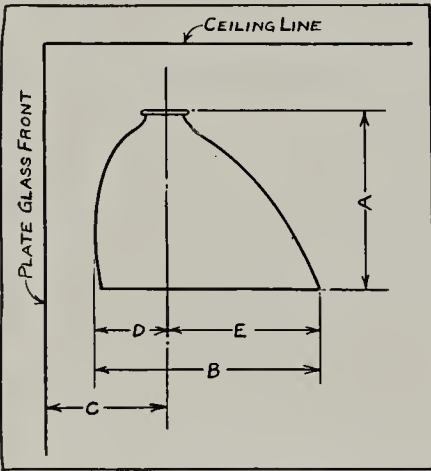


Diagram for use with Table 20



Copyrighted 1914—C. L. F. Co.

Window Valances

In order to conceal show window reflectors from the view of the observer on the street, window valances are used a great deal. In addition to performing the above function, they add a touch of refinement and exclusiveness to a show window, greatly increasing the attractiveness of the window.
Many attractive designs are now being manufactured, of which the one shown is typical.

Selection of Reflector

Chart No. 3 simplifies the selection of the correct reflector for any type of window. To begin with, knowledge of three things is necessary: Height, Depth of Window, and Height of Trim at Background.
Suppose, for example, the show window is 10' high, 6' deep and the trim or background to be lighted is 6' high.
First, find the height of the window (10') on the left-hand vertical scale. This point is indicated at "A."
Second, locate depth of window (6') on lower horizontal scale. This point is indicated at "B."
Third, move straight up from here to a point corresponding to the highest point to which the window is trimmed (in this case 6'). This point is indicated at "C."
Now note the diagonal line that most nearly passes through the two points, "A" and "C" (in this case it is a heavy dark line). By referring to the key below we find the reflector designated by the heavy dark line (————) is the VISOR, which is the correct reflector for this window. In the above example, if the window were 12' high, the chart calls for a HELMET reflector. This chart is based on the use of the lamp for which each reflector is designed.

Where it is necessary to place reflectors on the transom bar, they may be selected by using the distance from the floor of the window to the bar as the height of ceiling.

Table 20. Show Window Reflectors

REFLECTOR									LAMP		
No.	Dimensions—Inches						Position of Lamp	Holder**	Watts	No.	Bulb Base
	A	B	C	D	E	Width					
Scoop.....	6 $\frac{3}{4}$	7 $\frac{1}{2}$	5	2 $\frac{3}{8}$	5 $\frac{1}{8}$	9	Vertical	2 $\frac{1}{4}$ -O	60	S-21	Unskirted
Visor.....	9 $\frac{1}{16}$	10 $\frac{5}{8}$	6	3 $\frac{3}{8}$	7 $\frac{1}{4}$	9 $\frac{1}{2}$	Vertical	3 $\frac{1}{4}$ -A	100	S-30	Skirted
Helmet.....	10	11 $\frac{3}{4}$	7 $\frac{1}{4}$	4 $\frac{9}{16}$	7 $\frac{3}{16}$	12	Vertical	3 $\frac{1}{4}$ -A	100	S-30	Skirted
Poke Bonnet*..	5-7	7 $\frac{1}{2}$	4 $\frac{3}{4}$	2 $\frac{1}{2}$	5	14	Horizontal	Special	2-60	S-21	Unskirted
Hood.....	5 $\frac{7}{8}$	9 $\frac{1}{8}$	5 $\frac{5}{16}$	3 $\frac{5}{16}$	5 $\frac{1}{16}$	9	Vertical	2 $\frac{1}{4}$ -O	60	S-21	Unskirted

*Reflector supplied with special holder and twin socket.
**See Direct Lighting, Page 37

PLANNING THE LIGHTING EQUIPMENT

(Continued)

Spacing of Reflectors

In Table 21 is tabulated the reflector spacings recommended for:

- (1) Average Illumination Intensity.
- (2) Bright Illumination Intensity.
- (3) Very Bright Illumination Intensity.

The table is complete for all classes of windows previously mentioned.

It is found by experience that the brightness of illumination required in the window varies greatly with the locality. Thus, in many small towns, the street illumination is not of high intensity, and hence the spacings recommended under classification (1) "Average Illumination intensity," usually make the windows sufficiently bright to make them stand out by contrast with their surroundings. In the average size city, a somewhat higher intensity of illumination is required to produce the desired effect of making the window brighter than any of its surroundings, and hence the spacings recommended under classification (2), "Bright Illumination Intensity" are required. In the very large cities, a still higher intensity of illumination is required to obtain the same effect, necessitating reflector spacings as given under (3), "Very Bright Illumination Intensity."

Table 21. Reflector Spacings

Reflector		Distance Between Centers in Inches	Lamp Type	Watts	Class of Win- dow
Average Illumination Intensity					
Scoop	(No. 777)	28	Tungsten	60	A
Visor	(No. 780)	36	Tungsten	100	B
Helmet	(No. 755)	48	Tungsten	100	C
Poke Bonnet	(No. 750)	48	Tungsten	2-60	D
Hood	(No. 730)	28	Tungsten	60	E
Bright Illumination Intensity					
Scoop	(No. 777)	18	Tungsten	60	A
Visor	(No. 780)	24	Tungsten	100	B
Helmet	(No. 755)	36	Tungsten	100	C
Poke Bonnet	(No. 750)	36	Tungsten	2-60	D
Hood	(No. 730)	18	Tungsten	60	E
Very Bright Illumination Intensity					
Scoop	(No. 777)	10	Tungsten	60	A
Visor	(No. 780)	12	Tungsten	100	B
Helmet	(No. 755)	18	Tungsten	100	C
Poke Bonnet	(No. 750)	24	Tungsten	2-60	D
Hood	(No. 730)	10	Tungsten	60	E

NOTE. For Scoop-Hood combination use spacing recommended for either reflector.

In determining the reflector spacings best suited to the given conditions, one cannot be guided entirely by the size of the town, since many small cities compare very favorably with the larger cities insofar as brightness of street and window illumination is concerned, whereas many windows on streets in the outskirts of very large cities require no brighter illumination than those of a small city. The number and spacing of reflectors in a window resolves itself down to a case of using good judgment, but experience has shown Table 21 to be very useful as a guide.

Example

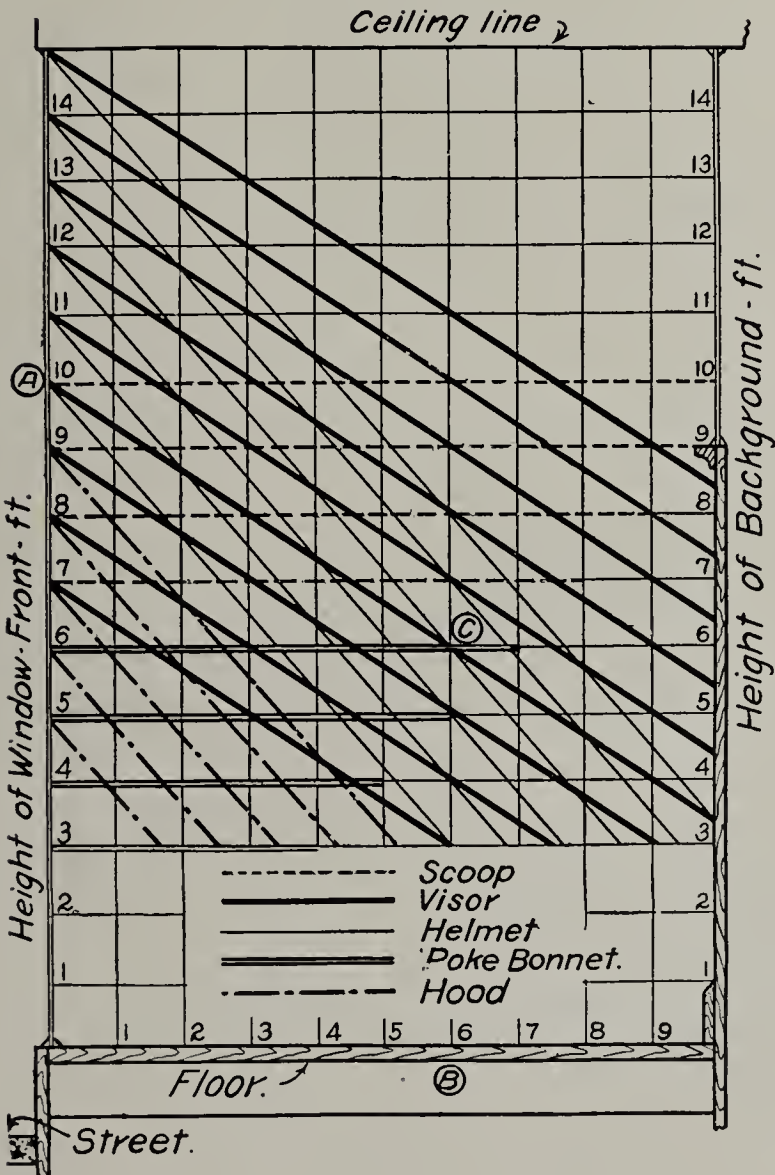
It is required to illuminate a show window, located in the downtown district of a city of 120,000 population, of the following dimensions:
Height 12', depth 5', trim 6', length 10'.
Goods displayed both light and dark.
Background dark oak; solid to top of trim; glass from there up to ceiling.

Referring to Chart No. 3, we find that a light unbroken line most nearly passes through the two points corresponding to the window under consideration. Hence the reflector required is the Helmet, with a 100-watt tungsten lamp.

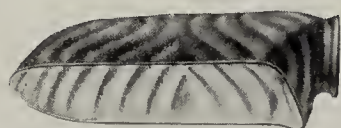
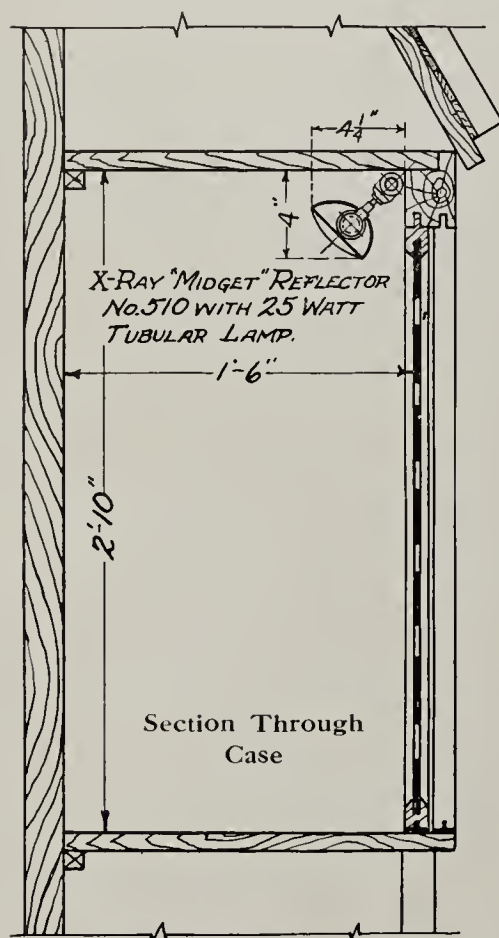
Since this window is located in the downtown district of a large city and both light and dark goods are displayed, it will be best to use the reflector spacing recommended under (3), "Very Bright Illumination Intensity." (Table 21).

The length of the window (10') divided by the recommended spacing, (18") equals 6²/₃. The use of 6 Helmet reflectors evenly spaced, on 20" centers, will be entirely satisfactory for this window.

Chart No. 3



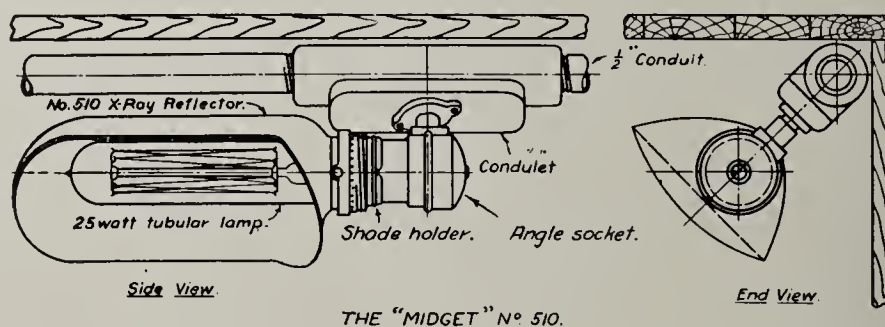
STORES AND DISPLAY ROOMS



The Midget No. 510

Installation Data

Number of cases 6	Height 2' 10"
Depth 1' 6"	Length 5' 0"
Reflectors Midget	Spacing 12" on centers
Lamps 25-watt tubular tungsten	Total number of reflectors installed 30



Show and wall case lighting is one of the most difficult problems to solve. The cases are usually comparatively high and very shallow. Very little room is allotted to the lighting equipment, which therefore must necessarily be small and compact.

The X-RAY Midget reflector is designed particularly for this class of service. It can be installed in connection with approved conduit work, and requires no special fittings. It is designed for use with a 25-watt tubular tungsten lamp.

The space required for its installation is very small as indicated in the accompanying sketches. The light distribution is correct, and the efficiency high. Its great advantage over the straight line filament lamp, lies in the fact that it uses a 110 volt multiple lamp, whereas the latter uses a 30 volt series lamp, with the consequent trouble of four lamps being extinguished when one burns out.

Barrett Mfg. Company

The illustration of the Barrett Mfg. Co.'s display room for building materials, presents an interesting problem in lighting. The principle of lighting from *concealed sources* has been fully carried out. The indirect fixtures supply adequate illumination to all portions of the display, except the material in the deep wall cases, where additional local illumination is required. This is furnished by Midget reflectors with 25-watt tungsten lamps installed as shown in the accompanying drawings.



Barrett Mfg. Co., Boston, Mass.

Installation made by Pettingel-Andrews Co.

MISCELLANEOUS DATA

Table 22. Average Horizontal Illumination on Working Plane for given Wattage with Indirect Lighting

Class A and B Installations—Efficiency of Utilization .30	
Watts per sq. ft.	Foot Candles
.25.....	.7
.50.....	1.5
.75.....	2.2
1.00.....	2.9
1.25.....	3.7
1.50.....	4.4
1.75.....	5.1
2.00.....	5.9
2.25.....	6.6
2.50.....	7.3
2.75.....	8.0
3.00.....	8.8

Class C Installations—Efficiency of Utilization .26

Watts per sq. ft.	Foot Candles
.25.....	.6
.50.....	1.3
.75.....	1.9
1.00.....	2.5
1.25.....	3.1
1.50.....	3.8
1.75.....	4.4
2.00.....	5.0
2.25.....	5.6
2.50.....	6.3
2.75.....	6.9
3.00.....	7.5

Table 23. Average Horizontal Illumination on Working Plane for given Wattage with Direct Lighting

Watts per sq. ft.	Foot Candles
.25.....	1.3
.50.....	2.7
.75.....	4.0
1.00.....	5.4
1.25.....	6.7
1.50.....	8.1
1.75.....	9.4
2.00.....	10.8
2.25.....	12.1
2.50.....	13.5
2.75.....	14.8
3.00.....	16.2

These values are calculated on the basis of a light production efficiency of 1 watt per horizontal candle power.

The efficiency of utilization is the total quantity of light flux effective in illuminating the working plane, expressed as a per cent of the total light flux delivered by the lamps.

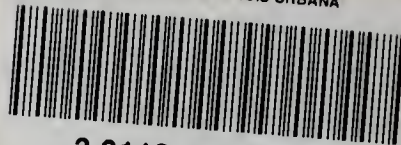
The working plane for these tables is taken as a horizontal plane 30" above the floor.

A foot-candle is the illumination received by a surface one foot distant from a light source of one candle power. It is a measure of the intensity of illumination received by an object.

Record Sheet of Illumination Computations

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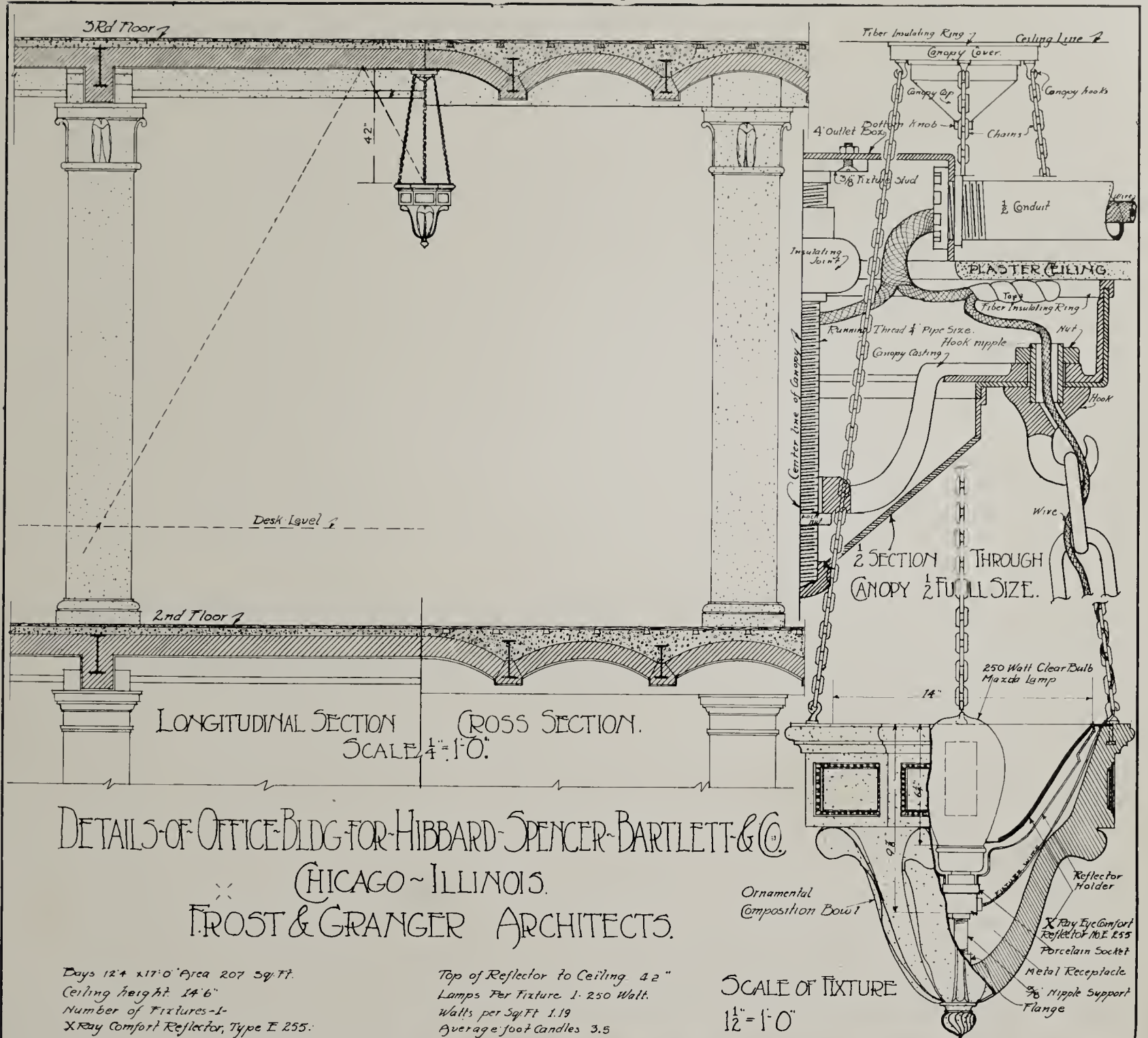
UNIVERSITY OF ILLINOIS-URBANA



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The Eye Comfort Lighting System FOR OFFICES.



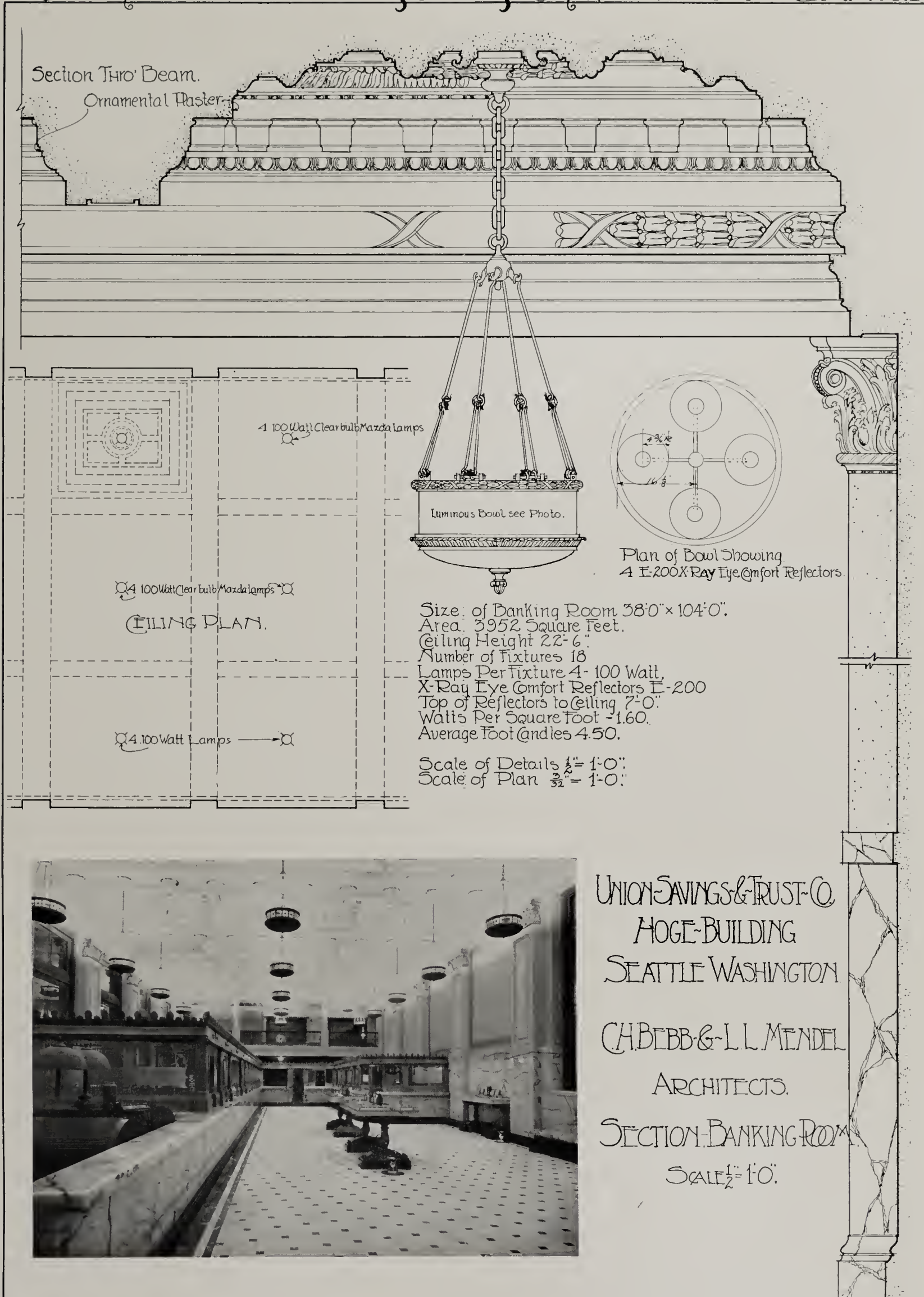
THE NATIONAL X-RAY REFLECTOR CO. 236 W. JACKSON BLVD CHICAGO-ILL.

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The Eye Comfort Lighting System FOR BANKS.



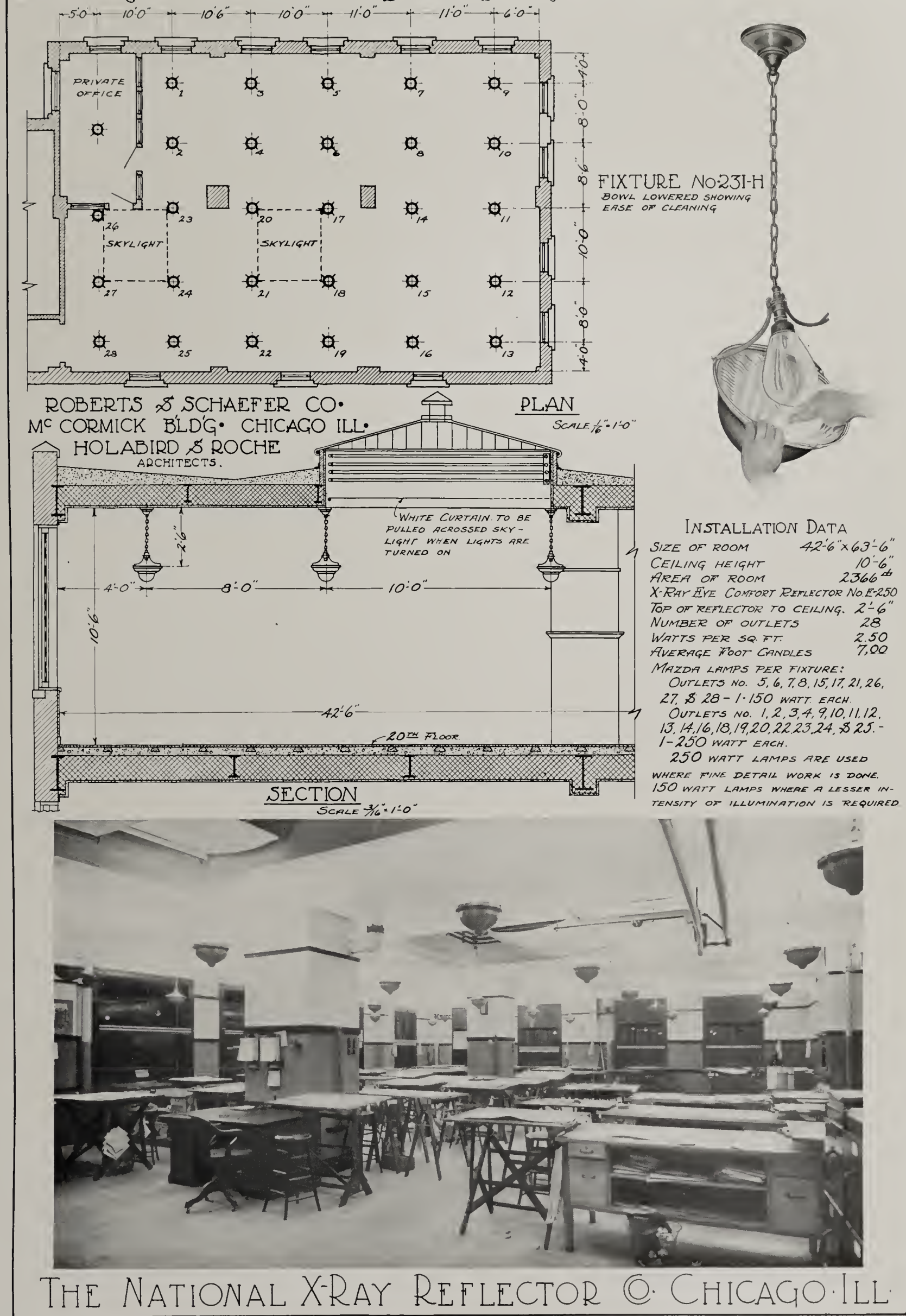
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The Eye Comfort Lighting System FOR DRAFTING ROOMS



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THE NATIONAL DAY DEFLECTION BOARD - CHICAGO - ILL.

q62' 32

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The Eye Comfort Lighting System FOR HOTELS & CLUBS



PART OF WEST-ELEVATION OF DINING-ROOM.
SCALE $\frac{1}{4}$ "=1'-0"



SIZE OF ROOM 38'-0" x 95'-0"
Ceiling Height 20'-0"
Area Of Room 3610 Sq. Ft.
X-Ray Eye Comfort Reflector-E255
Top of Reflector to Ceiling 12'-6"
Number of Outlets 8
Mazda lamps Per Pedestal-4-250-Watt, Clear bulb.
Watts Per Sq. Ft - 1.70
Foot Candles - 4.25.



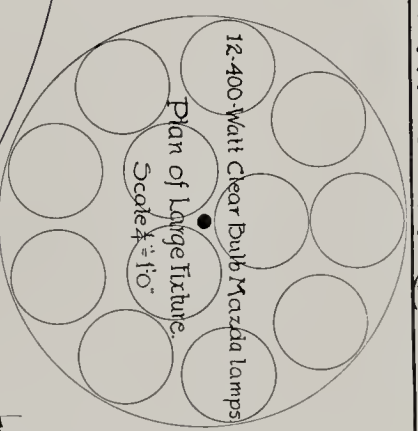
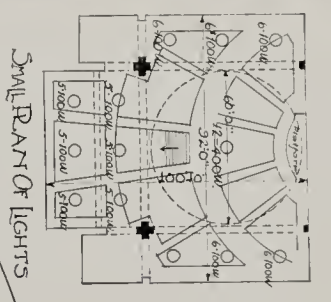
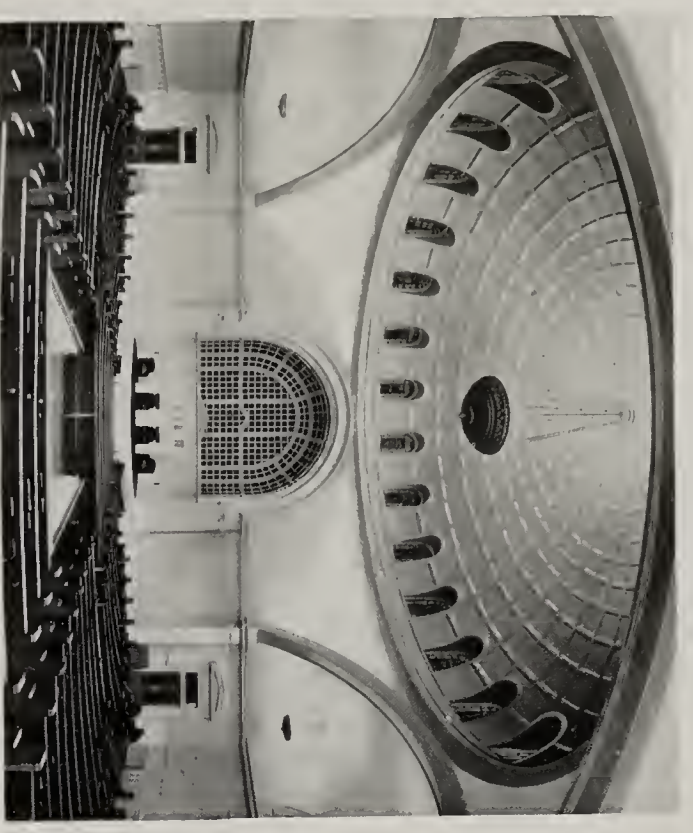
THE NATIONAL X-RAY REFLECTOR CO. 236 W. JACKSON BLVD. CHICAGO-ILL.

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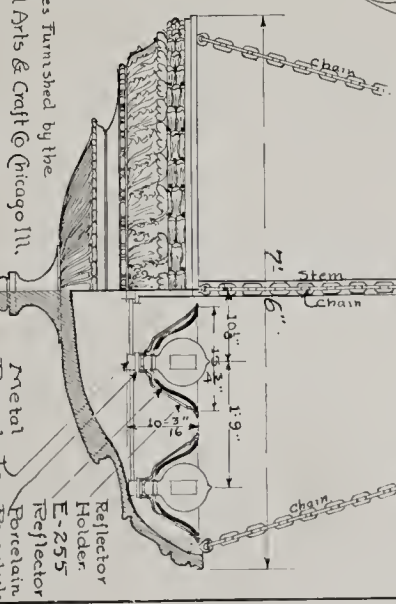
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The Eye Comfort Lighting System - For Churches.

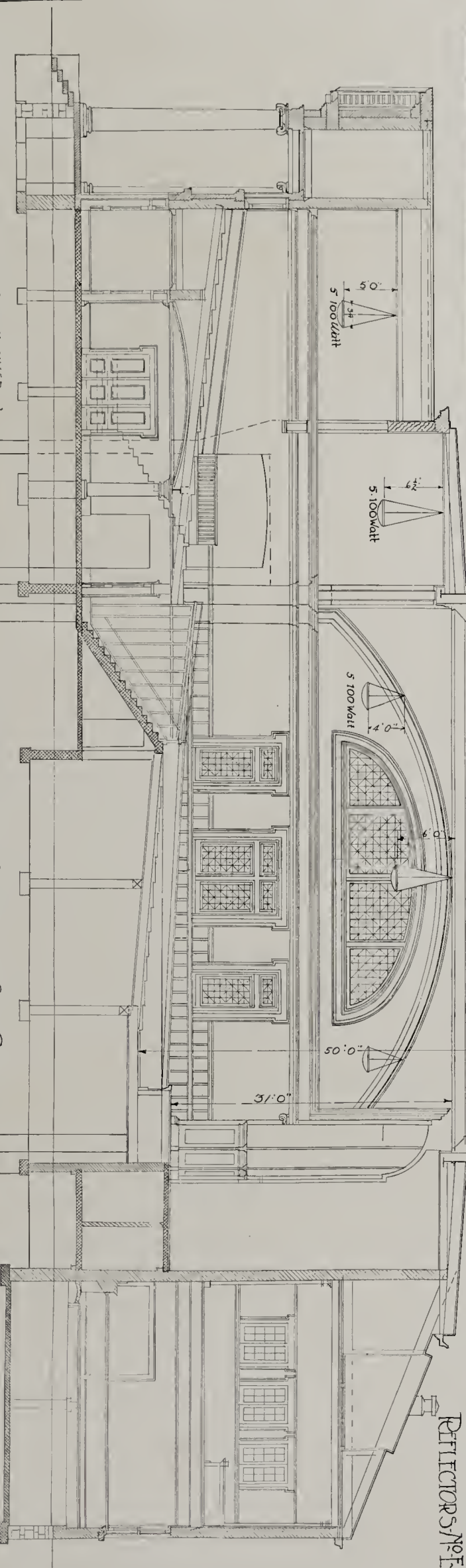


THIS FIXTURE & ALL OTHERS
IN THIS BUILDING CAN BE
LOWERED BY WINDLASS.
WRITE US FOR DETAILS.



Fixtures Furnished by the
Metal Arts & Craft Co Chicago Ill.

FIXTURE CONTAINING 12 - X-RAY EYE COMFORT
REFLECTORS NO. E-255



Number of fixtures 12 with 3/4\"/>

THE NATIONAL X-RAY REFLECTOR CO 230 W JACKSON BLVD CHICAGO ILL.

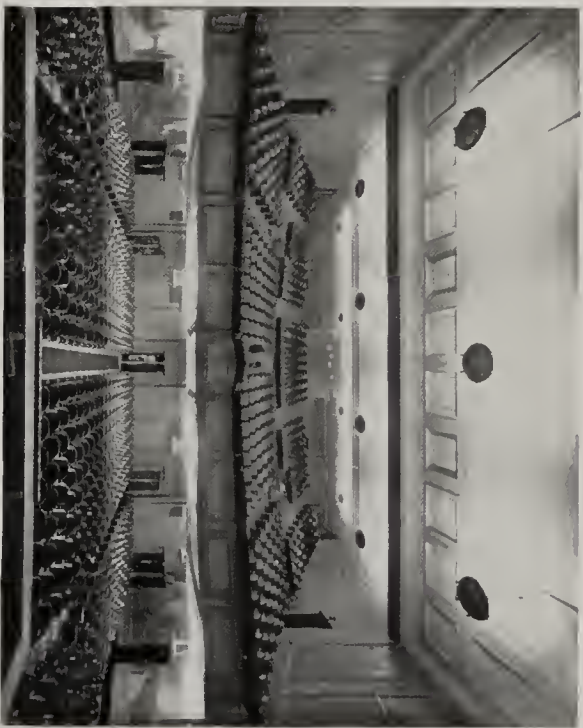
Leon E Stanhope Architect.
Chicago Ill.

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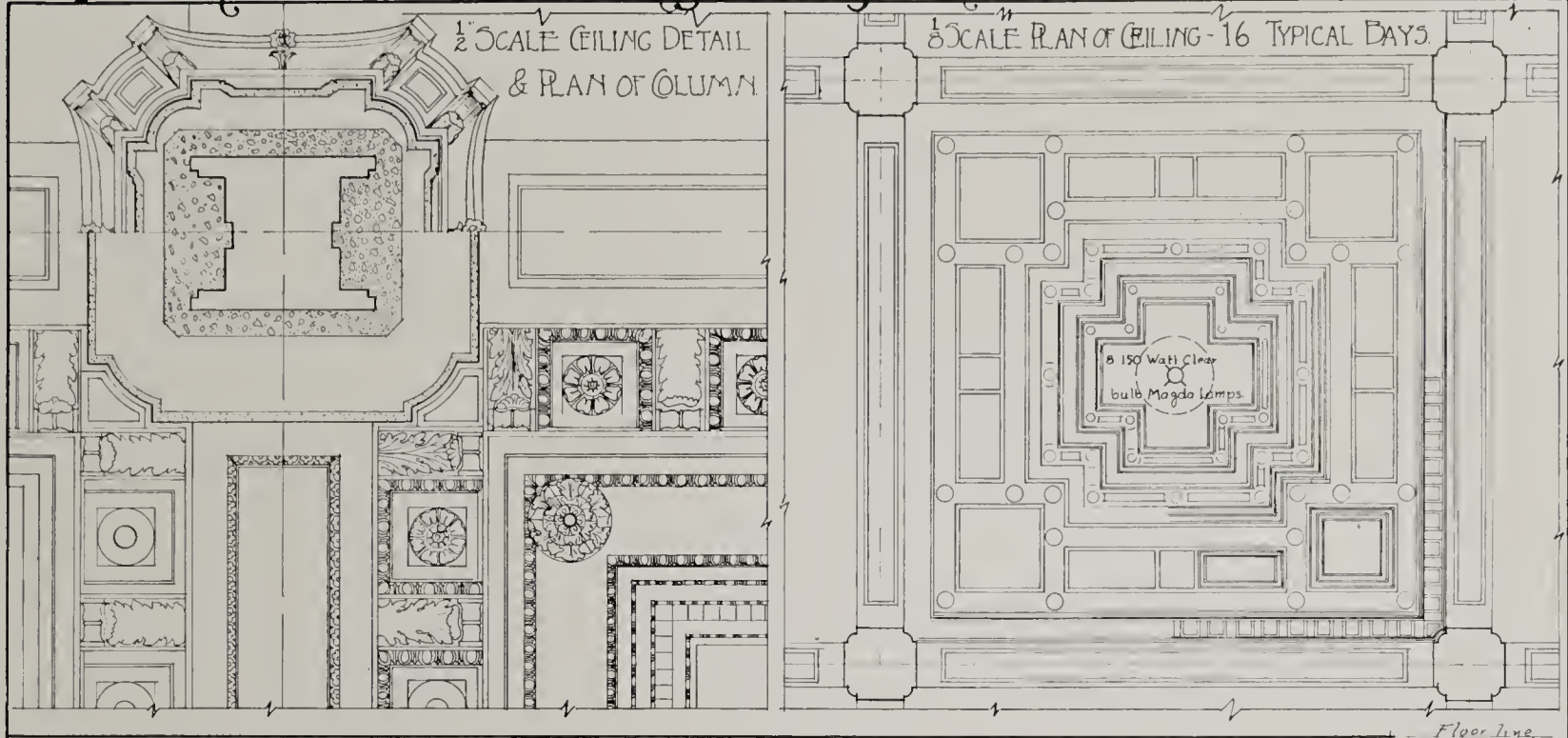
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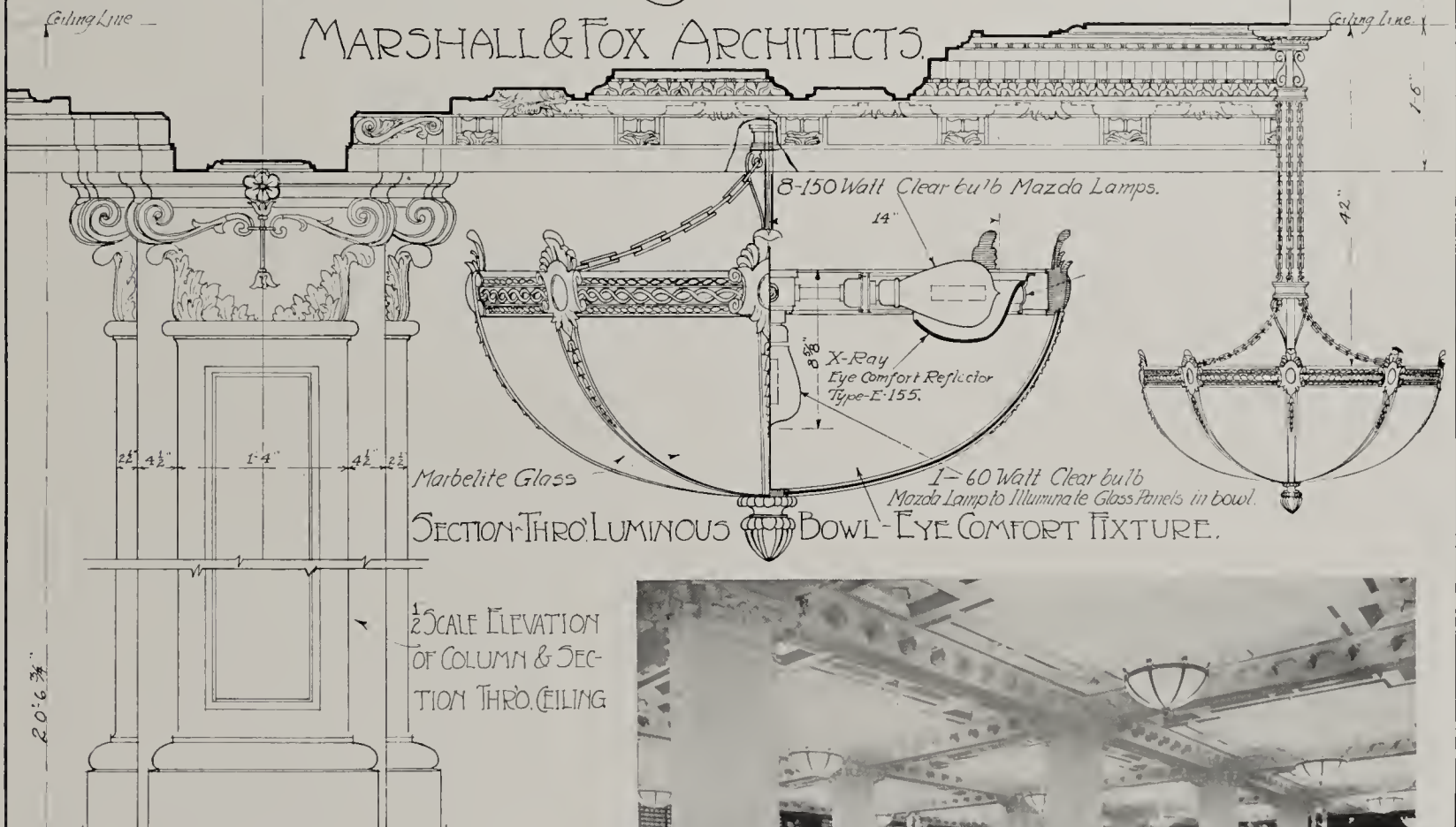
NOTE: X-Ray Eye Comfort Reflectors are used in all indirect fixtures & Clear bulb Mazda (Tungsten) lamps.



The Eye Comfort Lighting System FOR STORES.



DETAILS OF TYPICAL COLUMNS & CEILING ON MAIN FLOOR.
THE LYTTON BLDG. CHICAGO-ILLINOIS.
MARSHALL & FOX ARCHITECTS.



MAIN FLOOR DATA
Bays 22'-6" x 22'-6" - 16 Typical.
Area of Bays 506 Sq. Ft.
Ceiling height 20'-6 3/4"
Number of fixtures 1
X-Ray Eye Comfort Reflector Type E-155.
Top of Reflector to Ceiling 42".
Lamps per Fixture - 8-150 Watt Clear Bulb Mazda.
Watts per Sq. Ft. 2.38
Average foot Candles 7



THE NATIONAL X-RAY REFLECTOR CO. 236 W. JACKSON BLVD. CHICAGO-ILL.

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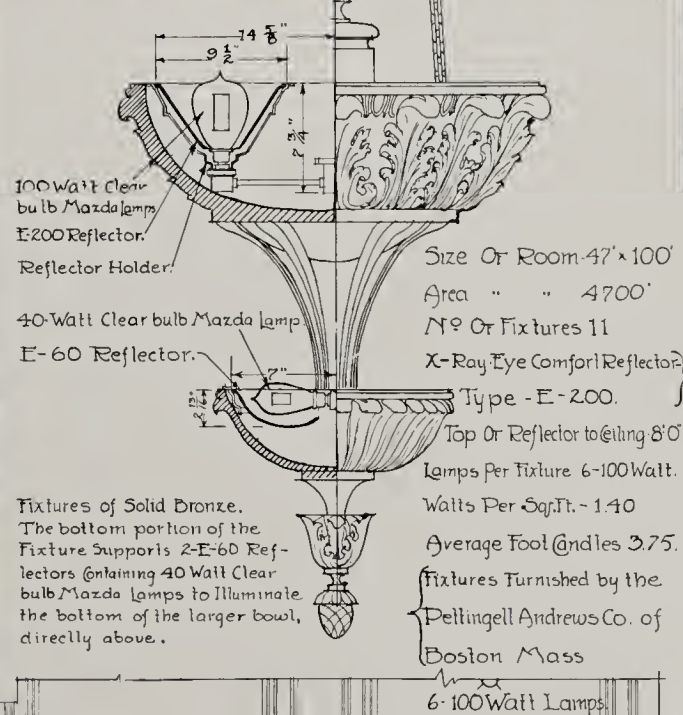
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The Eye Comfort Lighting System FOR LIBRARIES.



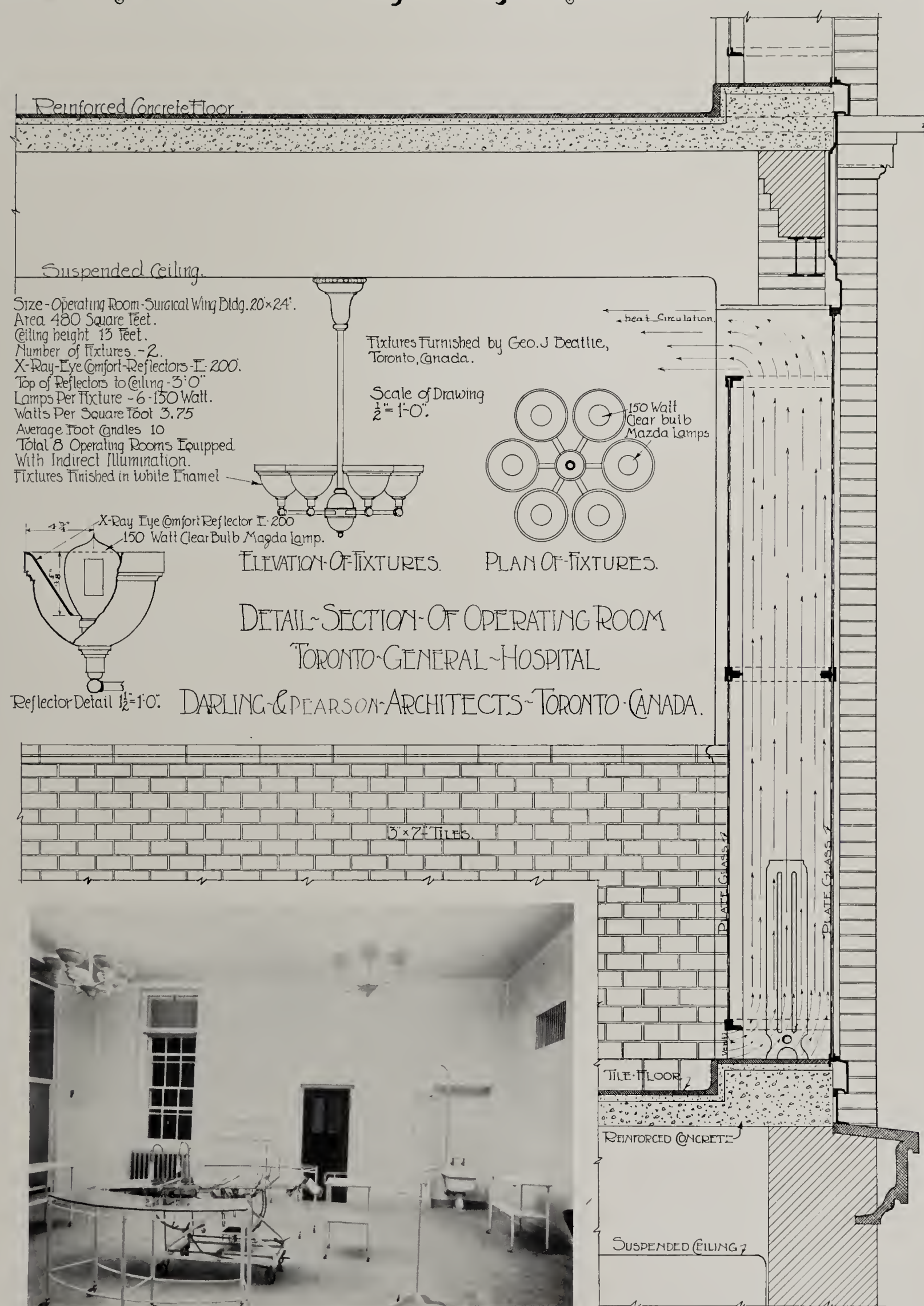
THE NATIONAL X-RAY REFLECTOR - 6236 W JACKSON BLVD CHICAGO ILL.

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The Eye Comfort Lighting System FOR HOSPITALS.



THE NATIONAL X-RAY REFLECTOR CO. 236 W. JACKSON BLVD. CHICAGO ILL.

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The Eye Comfort Lighting System - From Cornices.

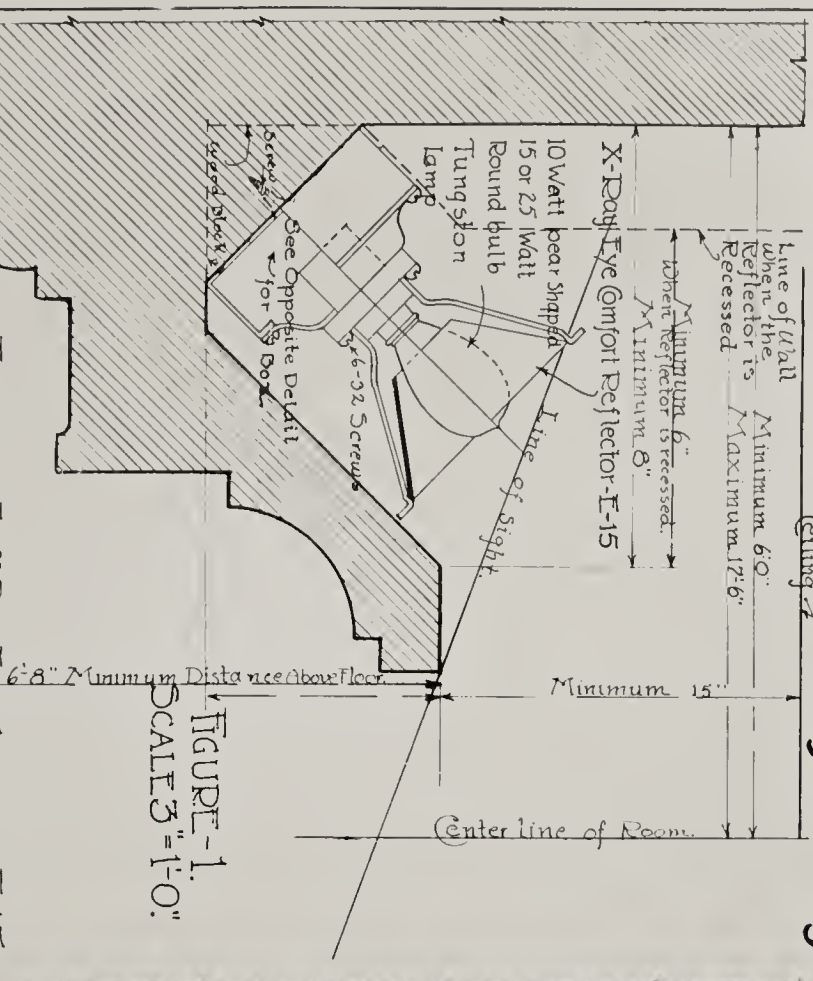
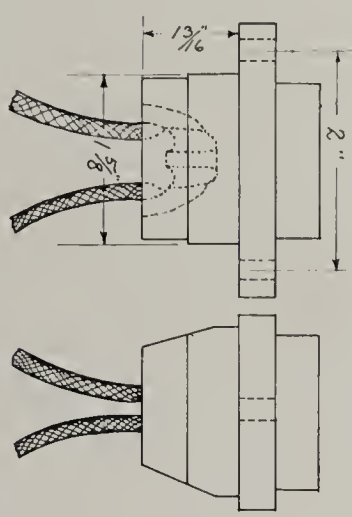


FIGURE 1.
SCALE 3"=1'-0"

EQUIPMENT FOR X-RAY EYE COMFORT E-15.

Applicable for Residences. Maximum Spacing of E-15 Reflectors 10'.
Example - Residence Ball Room - 50' Long - 25' Wide - 19' High at Center of arch, 11' High at sides of arch. 120 E-15 Reflectors with 1-10 watt lamp in each along each side. 60 E-15 Reflectors with 1-10 watt lamp in each along each end - Total 360 Reflectors on 5' Centers. 120 lamps tinted red, 120 lamps tinted blue. 120 lamps tinted amber. Lamps installed Alternately.



X-RAY DIGITAL RECEPTACLE No 8117.
This Receptacle can also be furnished with clamping terminals No 8118.

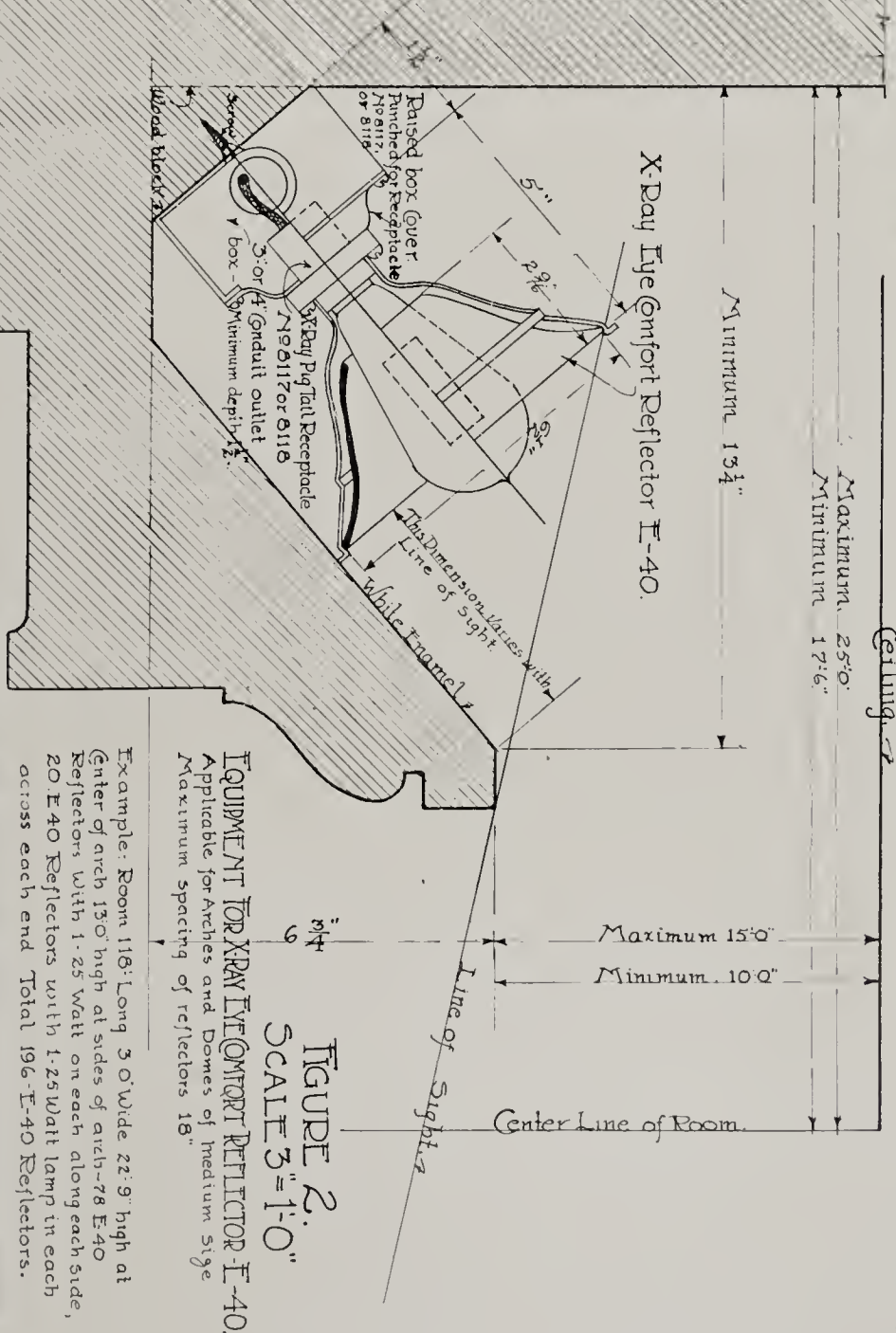


FIGURE 2.
SCALE 3"=1'-0"

EQUIPMENT FOR X-RAY EYE COMFORT REFLECTOR E-40.

Applicable for Arches and Domes of medium size. Maximum Spacing of reflectors 18'.
Example: Room 118' Long 30' Wide 22'9" high at Center of arch 13'0" high at sides of arch - 78 E-40 Reflectors with 1-25 watt on each along each side, 20 E-40 Reflectors with 1-25 watt lamp in each across each end Total 196 E-40 Reflectors.

INTERIOR OF RESIDENCE.
WALTER DURELY GRIFFIN
ARCHITECT.
Data on Photo
Living Room Size 15X25. Dining Room Size 15X18.
Ceiling Height 8'6".
X-Ray Eye Comfort Reflector E-15 E-15.
Top of Cornice to Ceiling 17' - 17'.
Lamps 60-10 watt. 45-10 watt.



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The Type Comfort Lighting System - From Cornices.

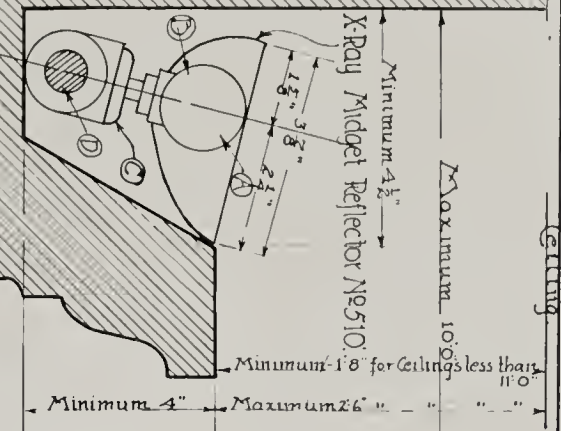


FIGURE 3.
SCALE 3/4" = 1'-0"

X-RAY MIDGET REFLECTOR No. 510.
Applicable for Rooms in Residences.
Maximum Spacing of Midgets 10"

Example: Room 20' long, 11' high, 18' wide.
Total 80 X-Ray Midget Reflectors, 10' Center to Center, 10 Watt tubular tungston lamp Special, in each reflector.

Ⓐ-25 Watt tubular Tungston lamp Or 10 Watt tubular Tungston lamp Special.
Ⓑ-1 1/8" Angle Socket holder. Ⓒ Conduit fitting with porcelain nipple over. Ⓓ-Conduit.

X-RAY POKE BONNET REFLECTOR No. 750.
Applicable for large wide arches & domes.
Maximum spacing of Poke Bonnets 26"

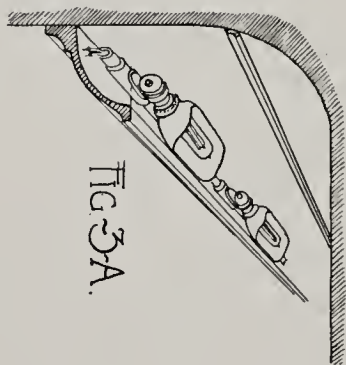


FIG. 3-A.

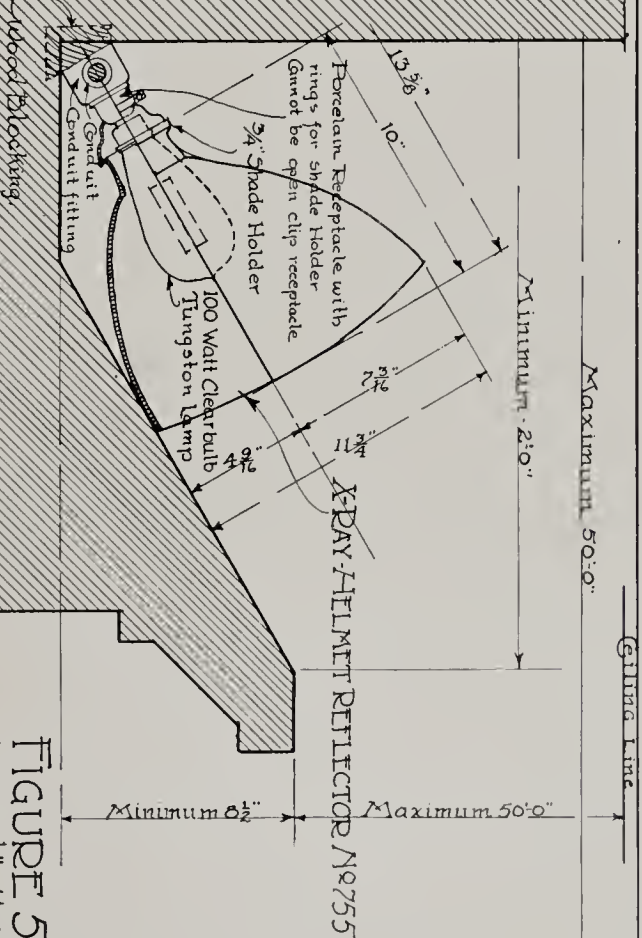


FIGURE 5.
SCALE 1/2" = 1'-0"

X-RAY-HELMET REFLECTOR No. 755.
Applicable for large high arches & domes.
Maximum spacing of helmets - 45'0"

Example: Room 28'0" Long, 48' feet wide, 52' high to Center of Room - 30' high at sides of arch. 26 Helmets along each side total 52 Helmets. 3'0" Center to Center. 100 Watt Clear bulb Tungston lamp in each Helmet.

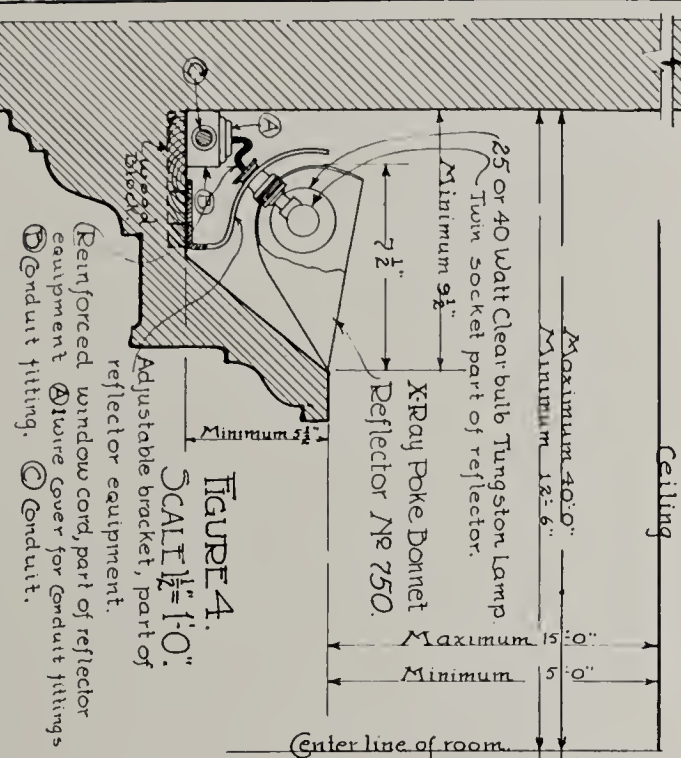


FIGURE 4.
SCALE 1/2" = 1'-0"

Ⓐ-25 or 40 Watt Clear bulb Tungston lamp.
Ⓑ-Adjustable bracket, part of reflector equipment.
Ⓒ-Reinforced window cord, part of reflector equipment.
Ⓓ-Twire cover for Conduit fittings.
Ⓔ-Conduit fitting.

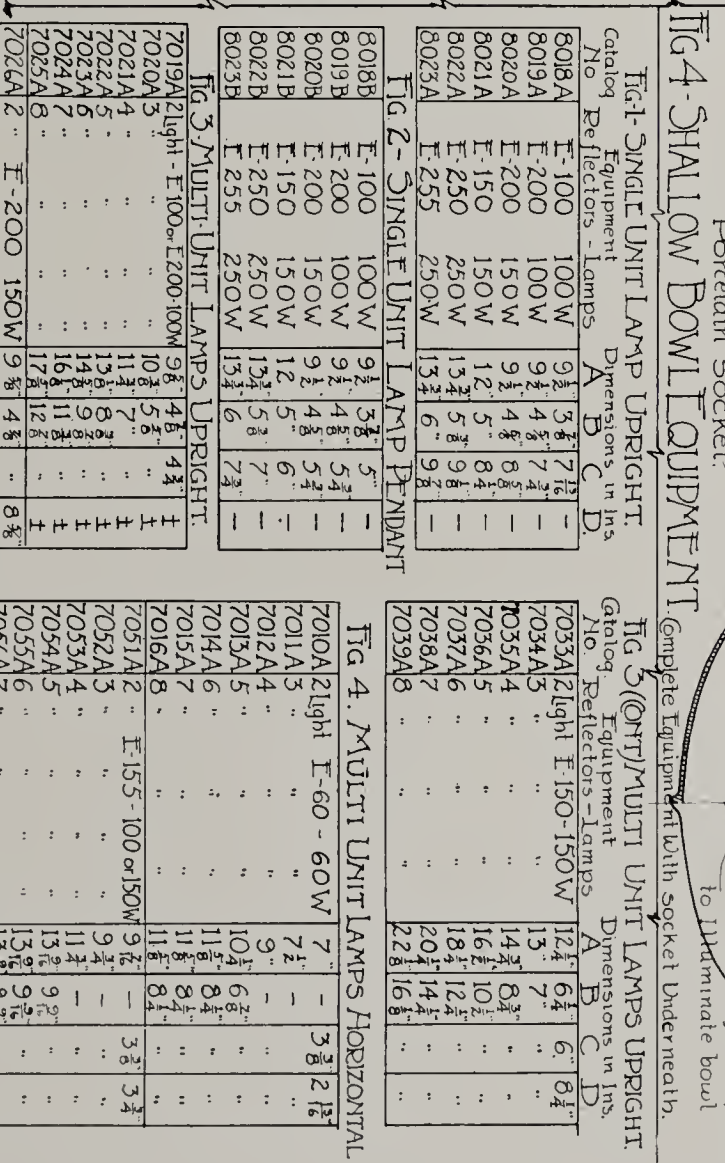
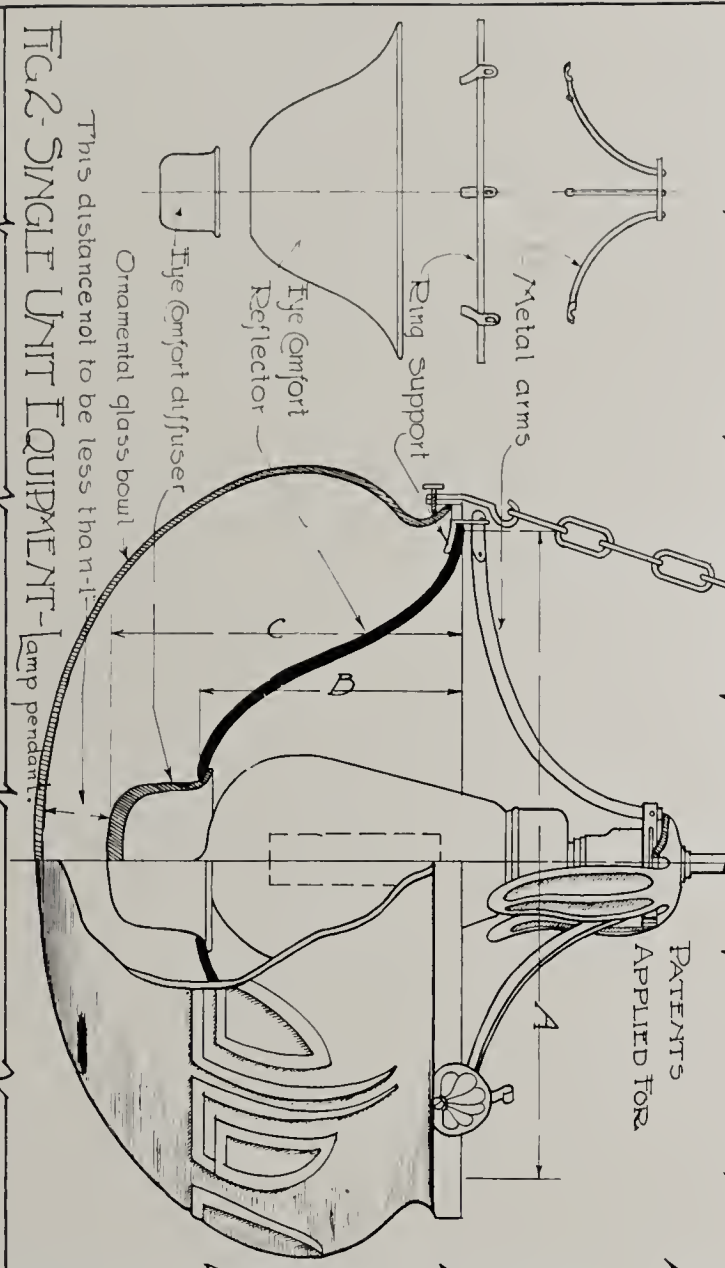
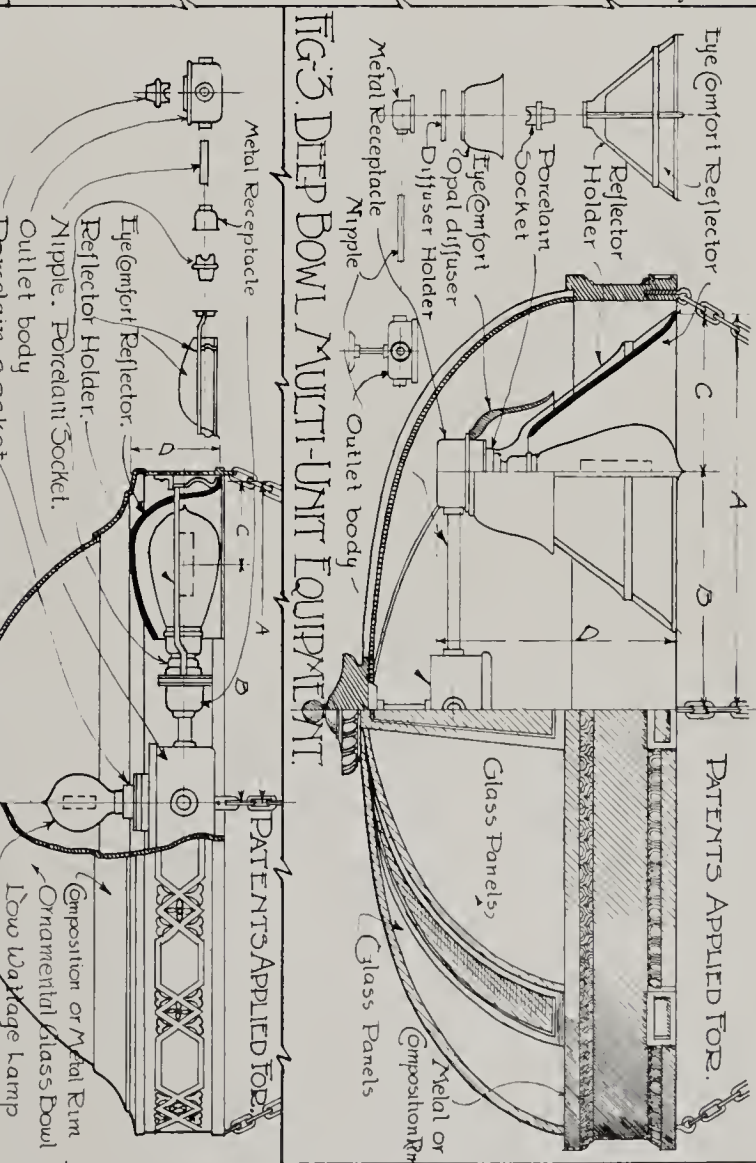
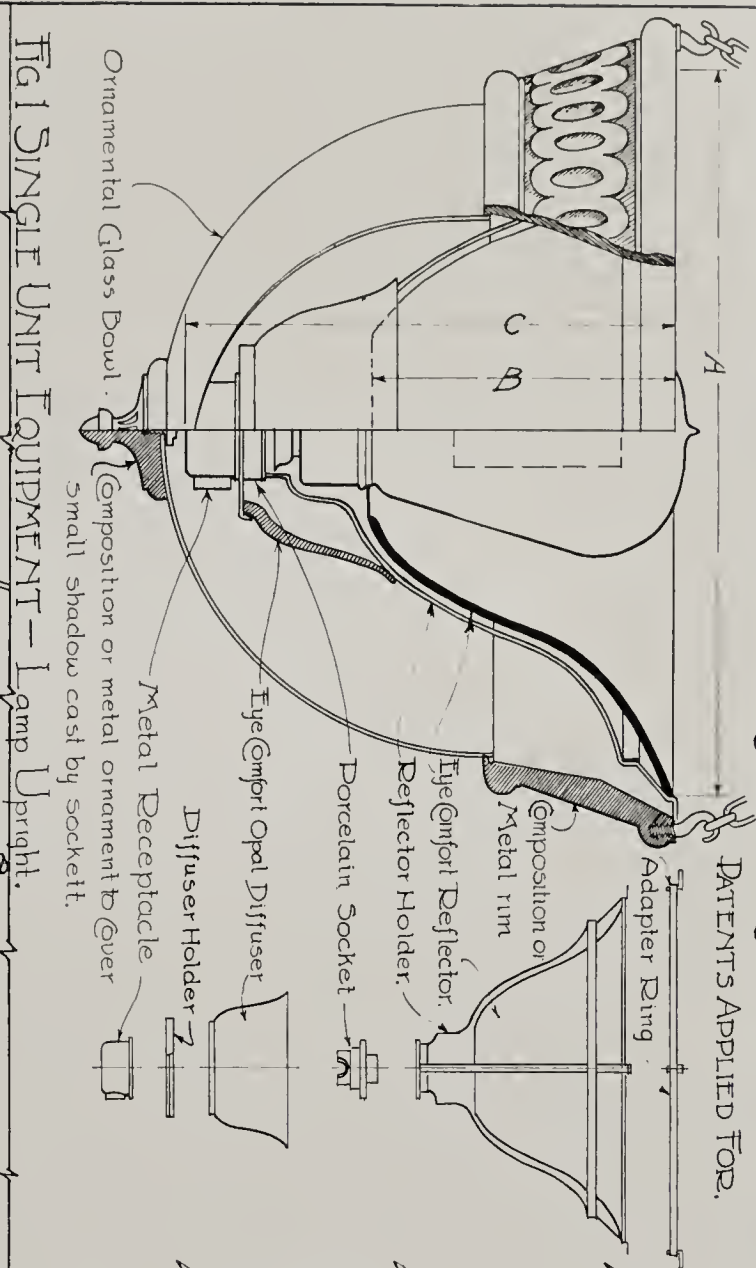
Example: Room 102' long, 55' wide, 49' high to Center of arch, 34' high at sides of arch.
50 X-Ray Poke Bonnets along each side.
26 of Same watt lamps in each reflector.
26 of Same watt reflectors along each end.
2-25 Watt lamps in each. Total 152 Reflectors.

PHOTOGRAPH-NORTH CHICAGO HERBREW GURCH.
ALFRED-S. ALSCHULER ARCHITECT.

Size of area lighted from cornice 48'0" X 78'0".
Height at center of arch 30' Height at sides of arch 30'0".
26 Helmets along each side.
Total 52 Helmets. 3' Center to Center. 100 Watt lamp in each reflector.
Average intensity of illumination 300 Foot Candles.



The Eye Comfort Lighting System - LUMINOUS BOWL EQUIPMENT.



THE LUMINOUS BOWL PRINCIPLE:—Luminous Bowl Eye Comfort fixtures are truly indirect and are not to be confused with the so-called "Semi-indirect." Just as in the opaque indirect fixtures of metal and "Composé" each lamp is equipped with an opaque X-RAY EYE COMFORT REFLECTOR for the purpose of directing the light rays against the ceiling at the correct angle, thus insuring perfect indirect illumination. In this standard reflector equipment, provision is made for utilizing a small per cent of the light to illuminate very softly the glass bowl or panels in the fixture, (see illustrations above). With this method the bowl is not shiny, nor harsh, nor obstructive. Its faint glow casts no objectionable shadows. It does not run the beautiful indirect illumination which is so essentially an illumination from concealed sources. In short, luminous bowl eye comfort fixtures possess artistically lighted bowls and do not sacrifice the indirect effect originally sought.

FIG 3 MULTI-UNIT LAMP UPRIGHT. This distance not to be less than 12 inches.

FIG 4 MULTI-UNIT LAMP PENDANT.

Catalog No.	Equipment	Dimensions in in.	A	B	C	D
8018A	E-100	100W	9 1/2	3 1/2	5 1/2	—
8019B	E-200	100W	9 1/2	4 1/2	5 1/2	—
8020B	E-200	150W	9 1/2	4 1/2	5 1/2	—
8021B	E-150	150W	12	5	6	—
8022B	E-250	250W	13 1/2	5 3/8	7 1/2	—
8023B	E-255	250W	13 1/2	6	7 3/4	—

Catalog No.	Equipment	Dimensions in in.	A	B	C	D
7033A	E-150-150W	150W	12 1/2	6 1/2	6	8 1/2
7034A	"	"	13	7	—	—
7035A	"	"	14 1/2	8 1/2	—	—
7036A	"	"	16 1/2	10 1/2	—	—
7037A	"	"	18 1/2	12 1/2	—	—
7038A	"	"	20 1/2	14 1/2	—	—
7039A	"	"	22 1/2	16 1/2	—	—

Catalog No.	Equipment	Dimensions in in.	A	B	C	D
7010A	E-60-60W	60W	7 1/2	—	3 3/8	2 1/2
7011A	"	"	7 1/2	—	—	—
7012A	"	"	9	—	—	—
7013A	"	"	10 1/2	6 1/2	—	—
7014A	"	"	11 1/2	8 1/2	—	—
7015A	"	"	11 1/2	8 1/2	—	—
7016A	"	"	11 1/2	8 1/2	—	—
7017A	"	"	11 1/2	8 1/2	—	—
7018A	"	"	11 1/2	8 1/2	—	—
7019A	"	"	11 1/2	8 1/2	—	—
7020A	"	"	11 1/2	8 1/2	—	—
7021A	"	"	11 1/2	8 1/2	—	—
7022A	"	"	11 1/2	8 1/2	—	—
7023A	"	"	11 1/2	8 1/2	—	—
7024A	"	"	11 1/2	8 1/2	—	—
7025A	"	"	11 1/2	8 1/2	—	—
7026A	"	"	11 1/2	8 1/2	—	—
7027A	"	"	11 1/2	8 1/2	—	—
7028A	"	"	11 1/2	8 1/2	—	—
7029A	"	"	11 1/2	8 1/2	—	—
7030A	"	"	11 1/2	8 1/2	—	—
7031A	"	"	11 1/2	8 1/2	—	—
7032A	"	"	11 1/2	8 1/2	—	—

Note: ± For E-100 Reflector-D=7 1/2".
E-200 " D=7 3/4".
Add 1/2 to catalogue No for E-200 Equipment.

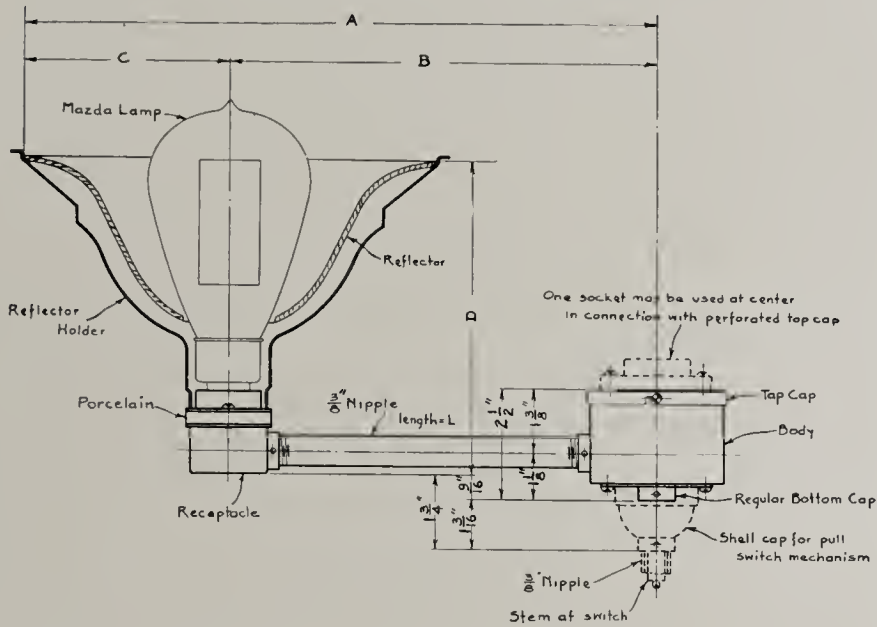
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The Eye Comfort Lighting System INTERIORS.

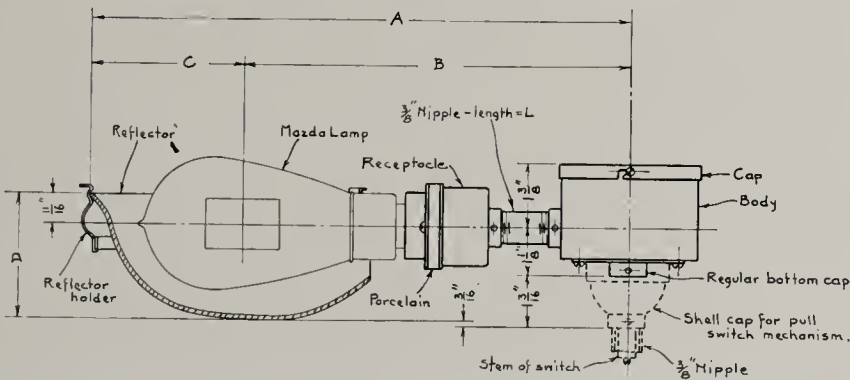
MULTI-UNIT INTERIORS
DEEP-BOWL TYPE.



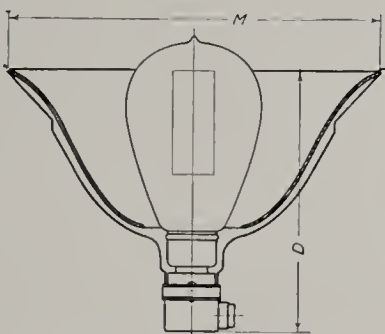
The general dimensions given on this sheet are intended primarily to indicate the minimum inside diameter and depth of fixtures in which these interiors are to be used. These interiors have been designed so as to keep the diameter a minimum, bent nipples being used on the 2, 3 and 4 light E-60 and the 2 and 3 light E-155 interiors to accomplish this.

* Indicates that one socket may be used at center of body in connection with perforated top cap.
For E-100 reflector $D=7\frac{3}{8}$, for E-200 $D=7\frac{3}{4}$.
† For E-250 reflector $D=9\frac{1}{8}$, for E-255 $D=9\frac{1}{8}$.

MULTI-UNIT INTERIORS
SHALLOW-BOWL TYPE.



SINGLE-UNIT INTERIORS.



The dimension M indicates the minimum inside diameter of the fixture in which the unit is to be used. It is the overall length of the horizontal E-155 unit.

Catalog No	Equipment		Dimensions			
	Reflectors - Lamps		A	B	C	D
7000	2 light, E-40 refl.	40w lamp	6 ⁵ / ₈	3 ³ / ₈	3 ¹ / ₄	5 ³ / ₈
7001	3 " " " "	" "	7 ¹ / ₈	3 ⁷ / ₈	"	"
7002	4 " " " "	" "	8	4 ³ / ₄	"	"
7003	5 " " " "	" "	9 ¹ / ₈	5 ⁷ / ₈	"	"
7004	6 " " " "	" *	10	6 ³ / ₄	"	"
7005	7 " " " "	" *	11	7 ³ / ₄	"	"
7006	8 " " " "	" *	12 ¹ / ₈	8 ⁷ / ₈	"	"
7007	9 " " " "	" *	13 ¹ / ₈	9 ⁷ / ₈	"	"
7008	10 " " " "	" *	14 ¹ / ₈	10 ⁷ / ₈	"	"
7019	2 lt E-100 or E-200 refl.	100w	9 ⁵ / ₈	4 ⁷ / ₈	4 ³ / ₄	†
7020	3 " " " "	" "	10 ³ / ₈	5 ⁵ / ₈	"	†
7021	4 " " " "	" "	11 ³ / ₄	7	"	†
7022	5 " " " "	" "	13 ¹ / ₈	8 ³ / ₈	"	†
7023	6 " " " "	" *	14 ⁵ / ₈	9 ⁷ / ₈	"	†
7024	7 " " " "	" *	16 ¹ / ₈	11 ³ / ₈	"	†
7025	8 " " " "	" *	17 ⁵ / ₈	12 ⁷ / ₈	"	†
7026	2 light E-200 1/2 refl.	150w lamp	9 ⁵ / ₈	4 ⁷ / ₈	"	8 ⁵ / ₈
7027	3 " " " "	" "	10 ³ / ₈	5 ⁵ / ₈	"	"
7028	4 " " " "	" "	11 ³ / ₄	7	"	"
7029	5 " " " "	" "	13 ¹ / ₈	8 ³ / ₈	"	"
7030	6 " " " "	" *	14 ⁵ / ₈	9 ⁷ / ₈	"	"
7031	7 " " " "	" *	16 ¹ / ₈	11 ³ / ₈	"	"
7032	8 " " " "	" *	17 ⁵ / ₈	12 ⁷ / ₈	"	"
7034	3 light, E-150 refl.	150w lamp	13	7	6	8 ¹ / ₄
7035	4 " " " "	" "	14 ³ / ₄	8 ³ / ₄	"	"
7036	5 " " " "	" "	16 ¹ / ₂	10 ¹ / ₂	"	"
7037	6 " " " "	" *	18 ¹ / ₄	12 ¹ / ₄	"	"
7038	7 " " " "	" *	20 ¹ / ₄	14 ¹ / ₄	"	"
7039	8 " " " "	" *	22 ¹ / ₈	16 ¹ / ₈	"	"
7040	9 " " " "	" *	24 ¹ / ₂	18 ¹ / ₂	"	"
7041	10 " " " "	" *	26 ¹ / ₄	20 ¹ / ₄	"	"
7045	3 lt E-250 or E-255 refl.	250w	15	8 ¹ / ₈	6 ⁷ / ₈	†
7046	4 " " " "	" "	16 ³ / ₄	9 ⁷ / ₈	"	†
7047	5 " " " "	" "	18 ⁷ / ₈	12	"	†
7048	6 " " " "	" "	21	14 ¹ / ₈	"	†
7049	7 " " " "	" "	23 ¹ / ₈	16 ¹ / ₄	"	†
7050	8 " " " "	" "	25 ³ / ₈	18 ¹ / ₂	"	†
7059	3 light E-255 1/2 refl.	400w lamp	15	8 ¹ / ₈	"	11
7060	4 " " " "	" "	17	10 ¹ / ₈	"	"
7061	5 " " " "	" "	19 ¹ / ₈	12 ¹ / ₄	"	"
7062	6 " " " "	" "	21	14 ¹ / ₈	"	"
7063	7 " " " "	" "	23 ¹ / ₈	16 ¹ / ₄	"	"
7064	8 " " " "	" "	25 ³ / ₈	18 ¹ / ₂	"	"
7066	3 lt. E-500 refl.	400 or 500 w	18 ⁵ / ₈	10 ¹ / ₈	8 ¹ / ₂	11 ³ / ₁₆
7067	4 " " " "	" "	20 ³ / ₄	12 ¹ / ₄	"	"
7068	5 " " " "	" "	23 ¹ / ₈	14 ⁵ / ₈	"	"
7069	6 " " " "	" "	26	17 ¹ / ₂	"	"
7070	7 " " " "	" "	28 ¹ / ₂	20	"	"
7071	8 " " " "	" "	31 ¹ / ₄	22 ³ / ₄	"	"

SHALLOW-BOWL EQUIPMENT.

7010	2 light E-60 refl.	60w lamp	6 ⁷ / ₈	...	3 ³ / ₈	2 ¹ / ₁₆
7011	3 " " " "	" "	7 ¹ / ₈	...	"	"
7012	4 " " " "	" "	8 ³ / ₈	...	"	"
7013	5 " " " "	" "	9 ⁵ / ₈	6 ¹ / ₄	"	"
7014	6 " " " "	" "	10 ⁵ / ₈	7 ¹ / ₄	"	"
7015	7 " " " "	" "	10 ⁵ / ₈	7 ¹ / ₄	"	"
7016	8 " " " "	" "	11 ¹ / ₂	8 ¹ / ₈	"	"
7051	2 lt E-155 refl.	100 or 150w	9 ⁷ / ₈	...	4	3 ⁷ / ₈
7052	3 " " " "	" "	9 ⁵ / ₈	...	"	"
7053	4 " " " "	" "	11 ³ / ₄	7 ³ / ₄	"	"
7054	5 " " " "	" "	13 ³ / ₁₆	9 ³ / ₁₆	"	"
7055	6 " " " "	" "	13 ³ / ₁₆	9 ³ / ₁₆	"	"
7056	7 " " " "	" "	13 ³ / ₁₆	9 ³ / ₁₆	"	"
7057	8 " " " "	" "	14 ³ / ₁₆	10 ³ / ₁₆	"	"

SINGLE-UNIT EQUIPMENT. M D

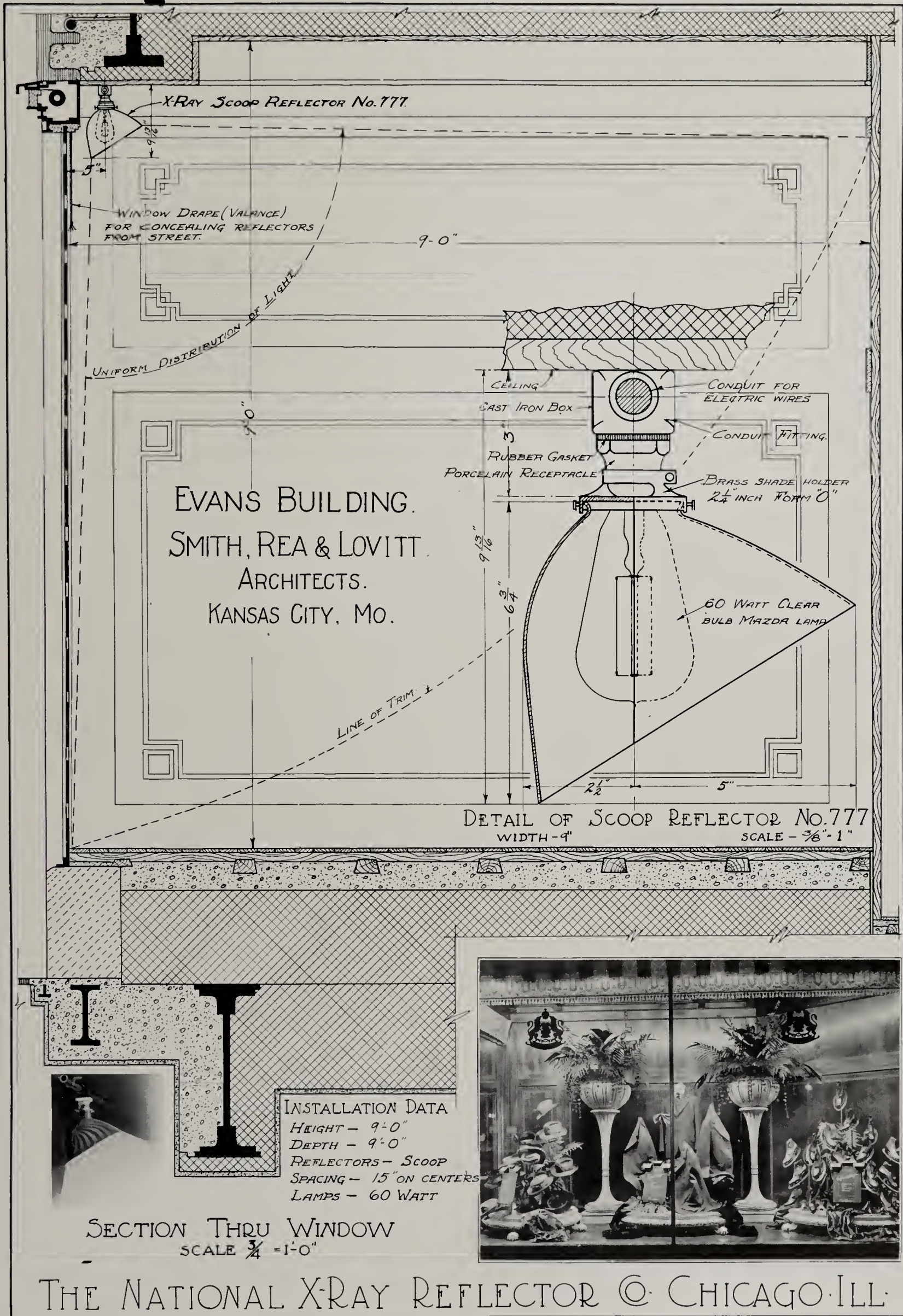
8016	E-40 reflector	40watt lamp	6 ¹ / ₂	5 ³ / ₈
8112	E-155 " "	-100 or 150w lamp	11	3 ⁷ / ₈
8018	E-100 " "	-100watt lamp	9 ¹ / ₂	7 ³ / ₁₆
8019	E-200 " "	-100 " "	9 ¹ / ₂	7 ³ / ₄
8020	E-200 1/2 " "	-150 " "	9 ¹ / ₂	8 ⁵ / ₈
8021	E-150 " "	-150 " "	12	8 ¹ / ₄
8022	E-250 " "	-250 " "	13 ³ / ₄	9 ¹ / ₈
8023	E-255 " "	-250 " "	13 ³ / ₄	9 ⁷ / ₈
8110	E-255 1/2 " "	-400 " "	13 ³ / ₄	11
8111	E-500 " "	-400 or 500w lamp.	17	11 ³ / ₁₆

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X-Ray Reflectors For Show Windows

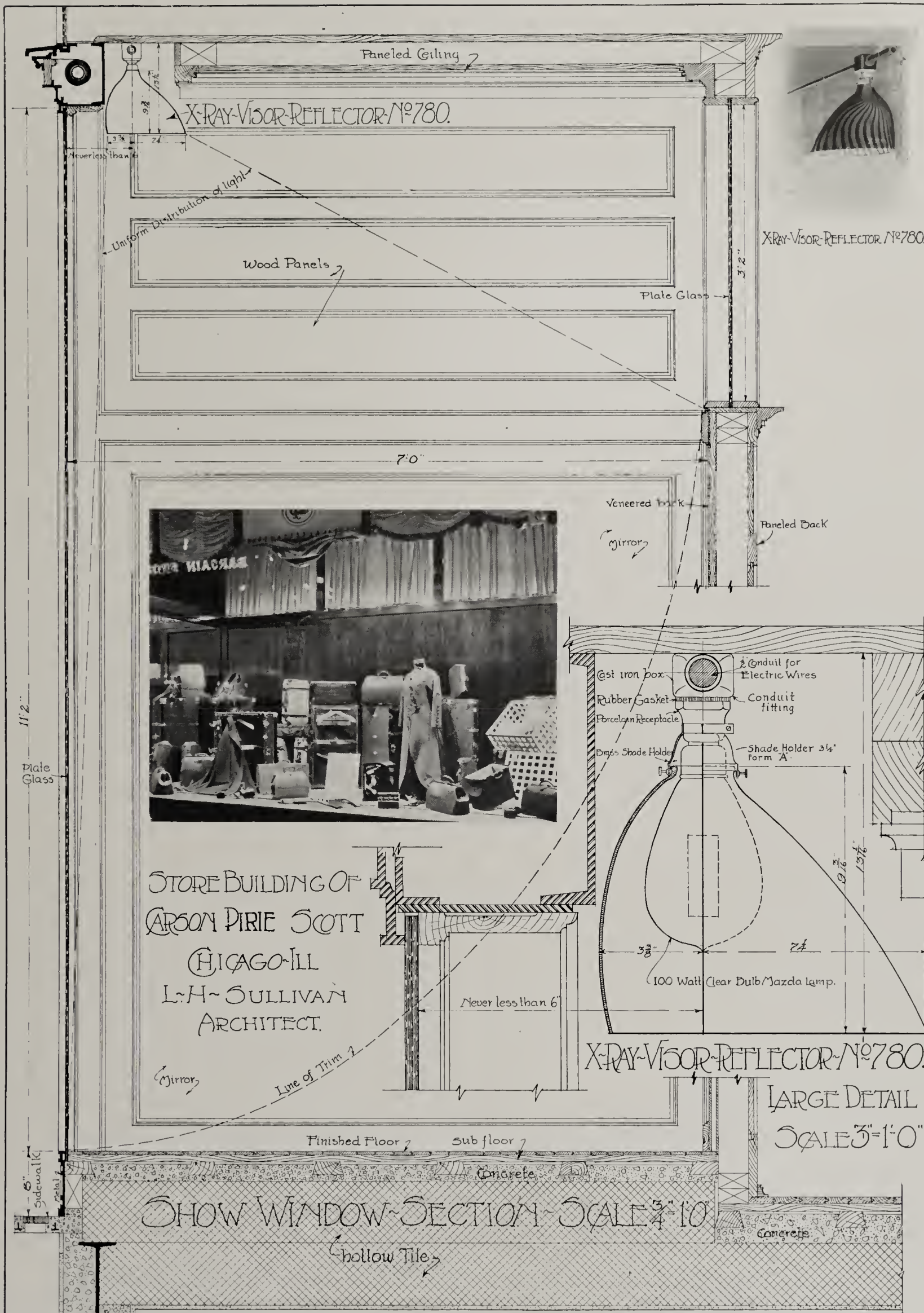


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X-Ray Reflectors FOR SHOW WINDOWS.



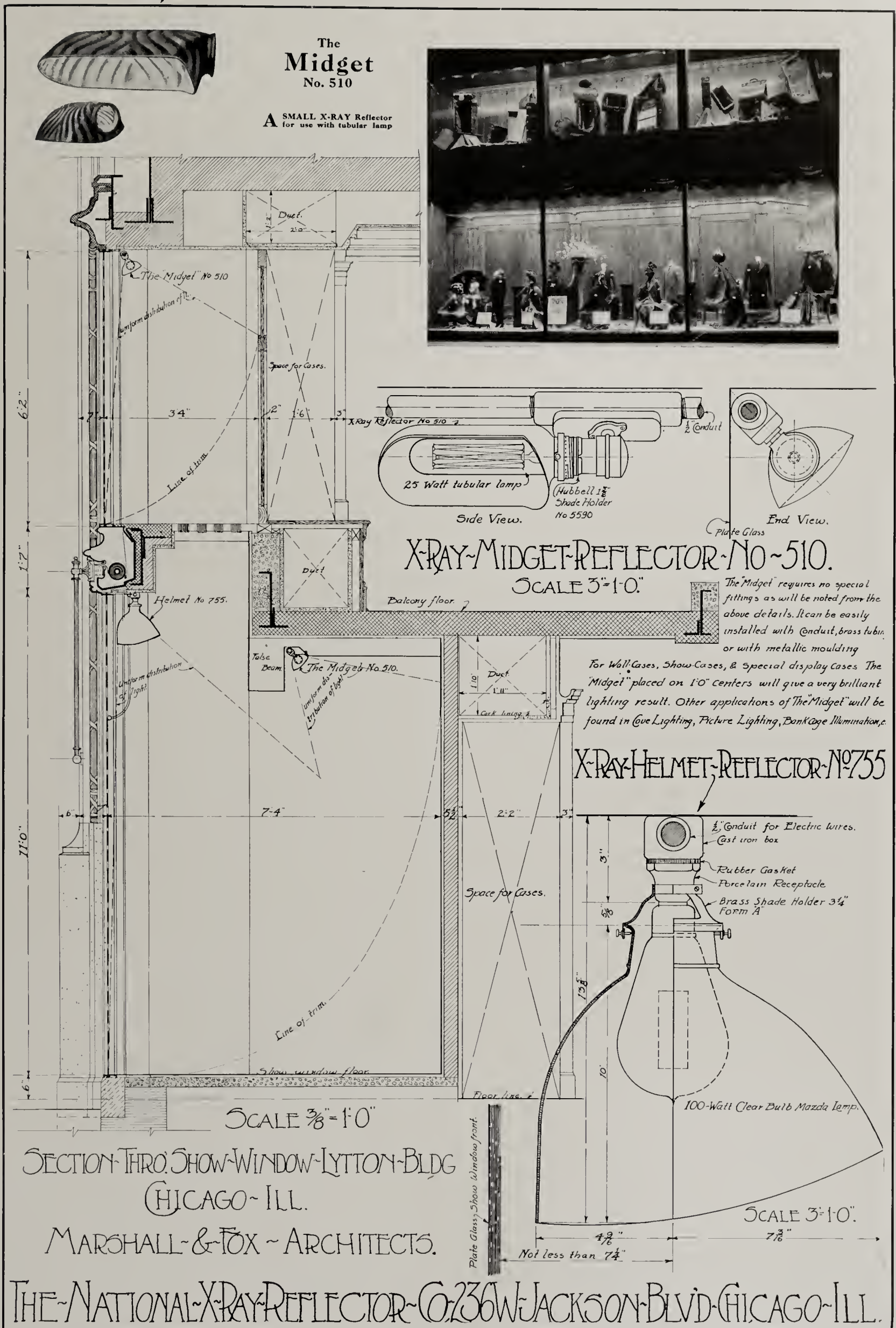
THE NATIONAL X-RAY REFLECTOR CO. 236 W JACKSON BLVD CHICAGO-ILL.

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X-Ray Reflectors FOR SHOW WINDOWS

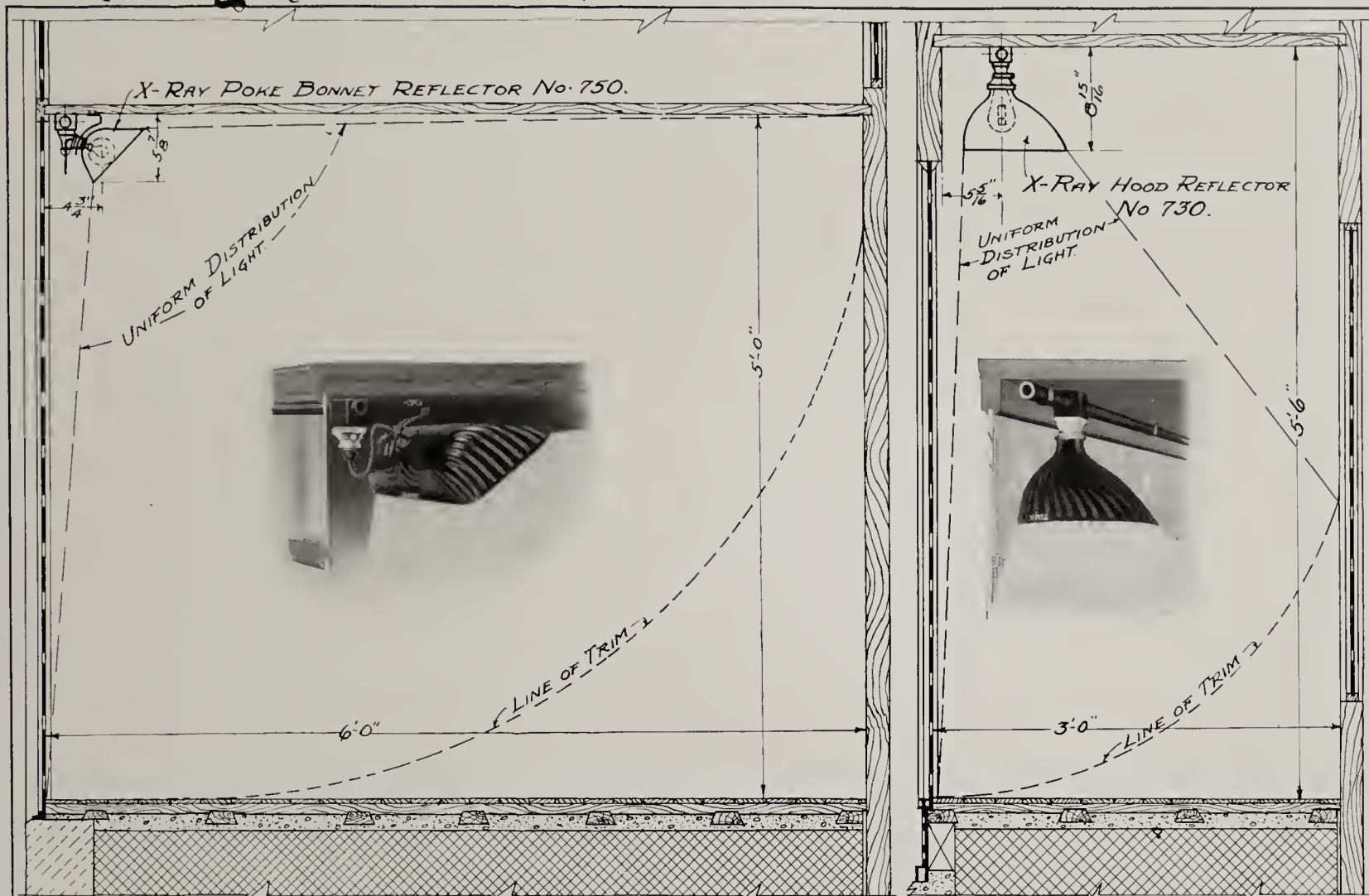


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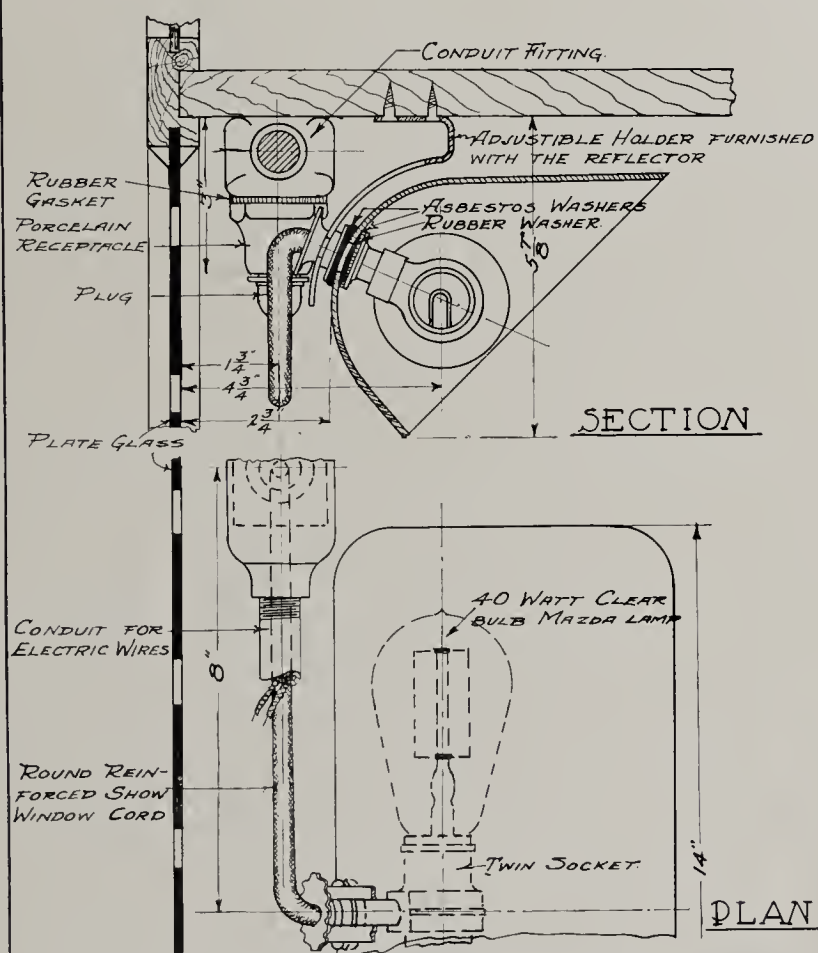
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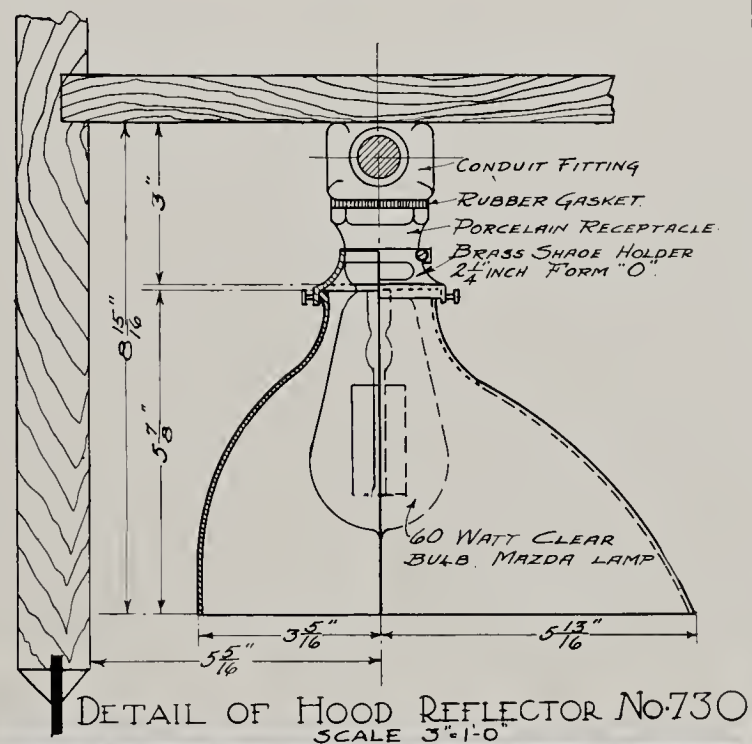
X-Ray Reflectors For Show Windows



SECTIONS THRU TYPICAL WINDOWS
SCALE $\frac{3}{4} = 1'-0"$



DETAIL OF POKE BONNET REFLECTOR No. 750
SCALE $3" = 1'-0"$



DETAIL OF HOOD REFLECTOR No. 730
SCALE $3" = 1'-0"$

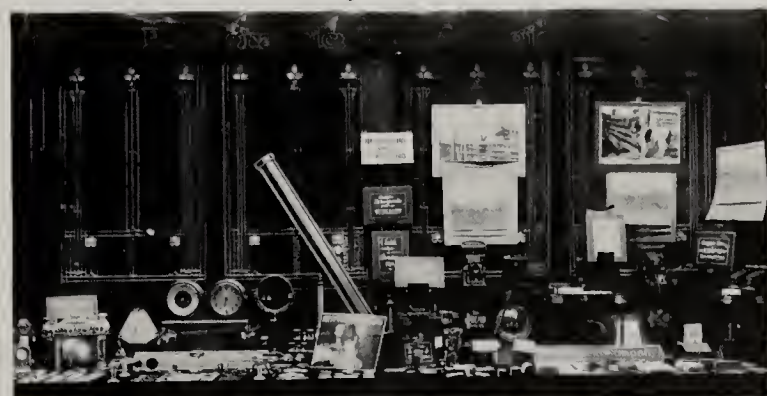


ILLUSTRATION:
WINDOW EQUIPPED WITH HOOD REFLECTORS
ALMER COE & CO. OTIS BLDG CHICAGO
REFLECTORS SPACED 18 IN. ON CENTERS

THE NATIONAL X-RAY REFLECTOR © CHICAGO-ILL.

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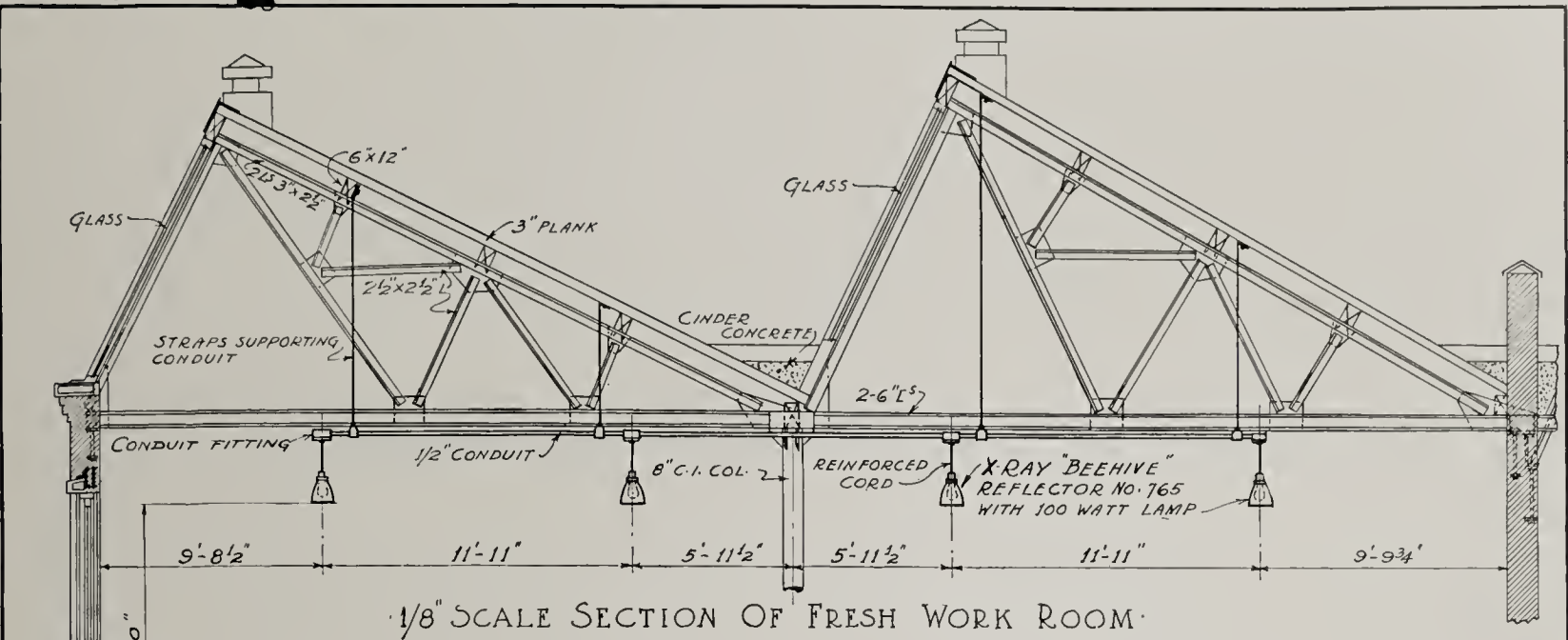
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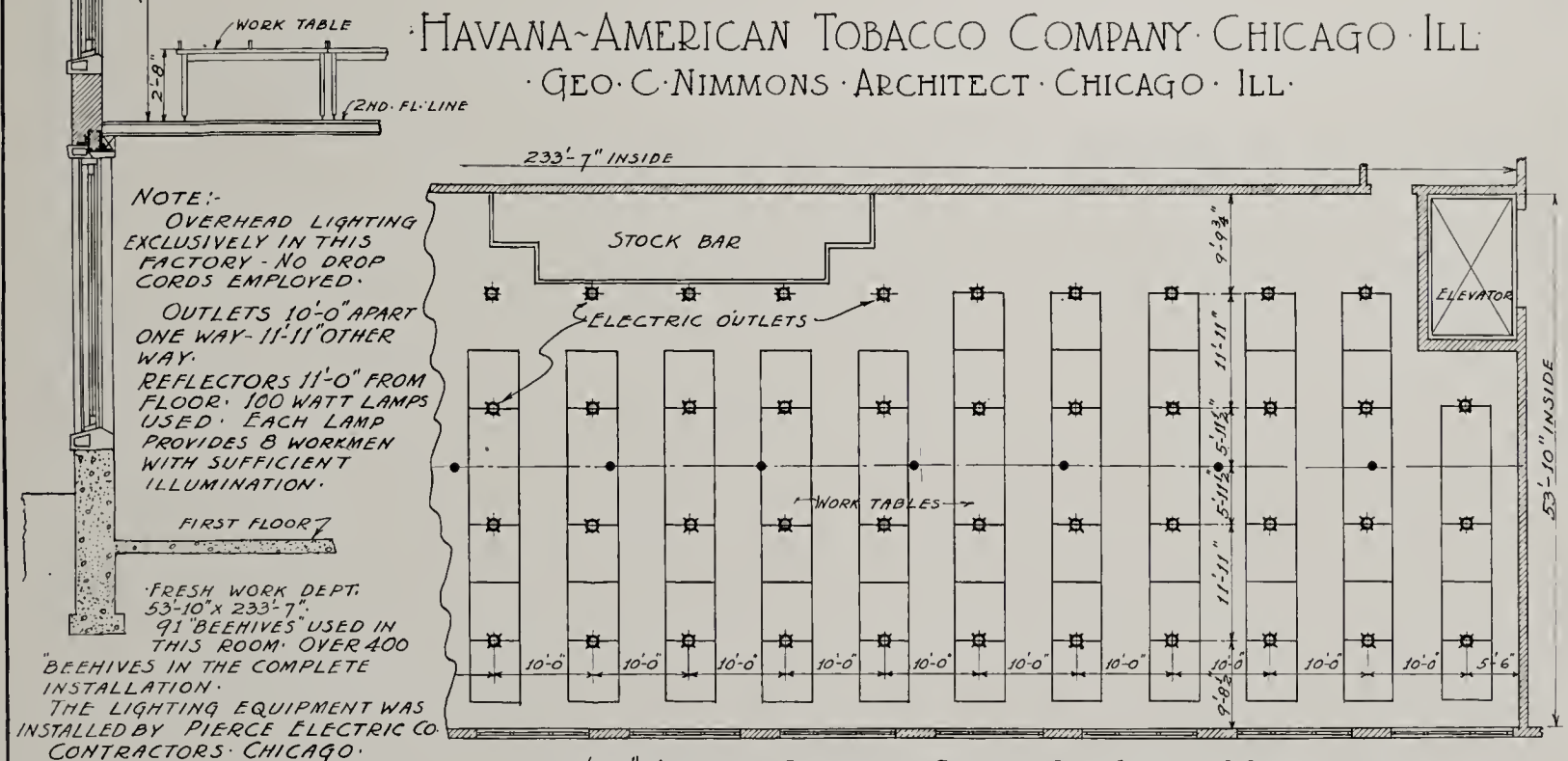
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X-Ray Reflectors For Factories, Shops & Workshops

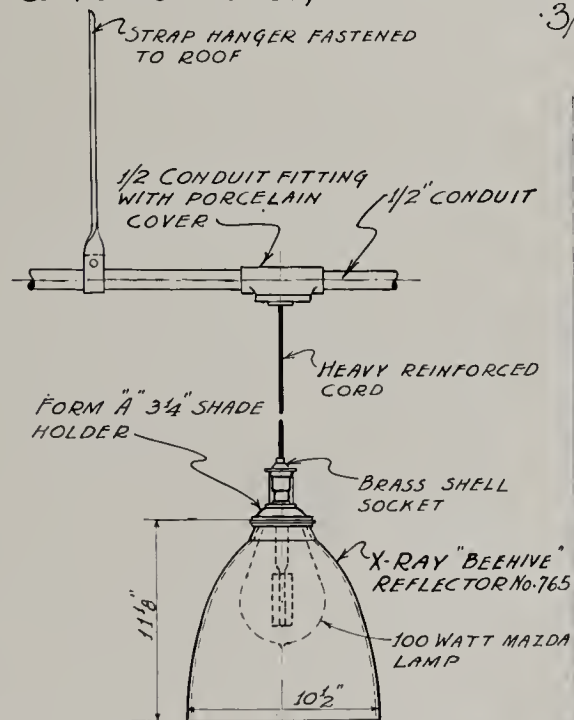


1/8" SCALE SECTION OF FRESH WORK ROOM.

HAVANA-AMERICAN TOBACCO COMPANY, CHICAGO, ILL.
GEO. C. NIMMONS, ARCHITECT, CHICAGO, ILL.



3/64" SCALE PARTIAL PLAN OF FRESH WORK ROOM.
SHOWING LOCATION OF LIGHTING UNITS.



DETAIL OF LIGHTING FIXTURE
SHOWING METHOD OF SUSPENDING
FROM 'SAWTOOTH' ROOF - 1" SCALE.



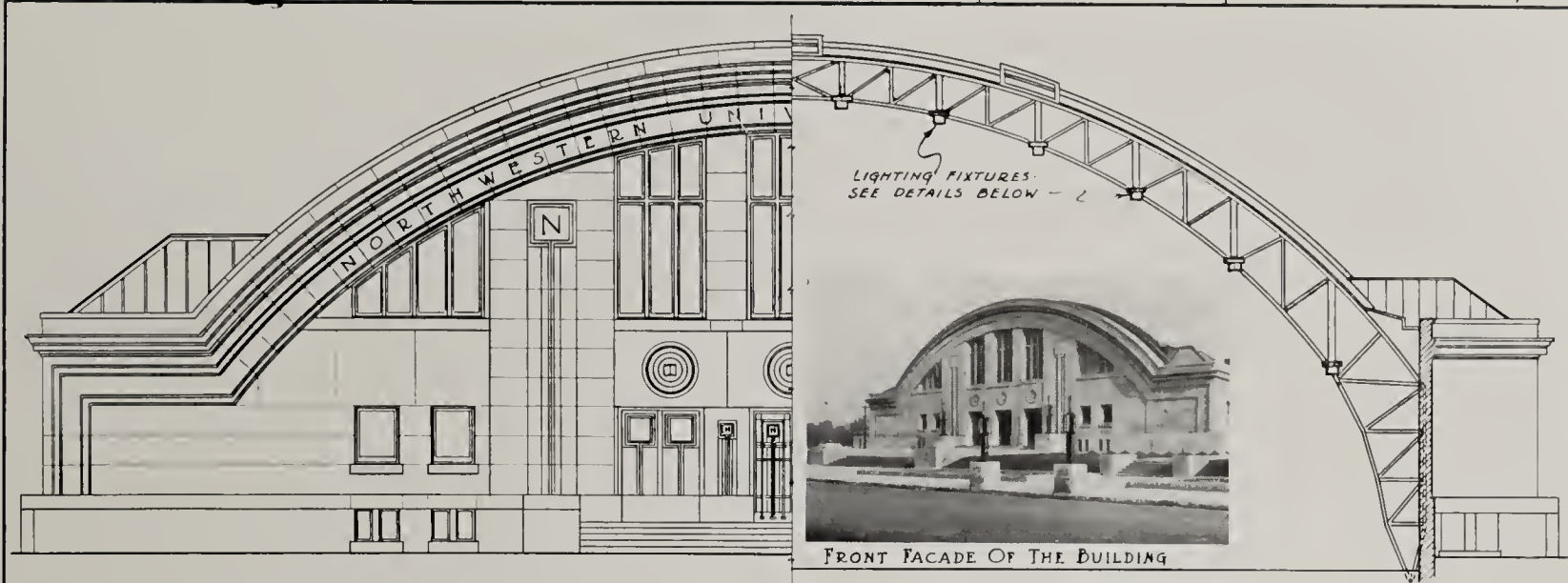
THE NATIONAL X-RAY REFLECTOR CO. CHICAGO, ILL.

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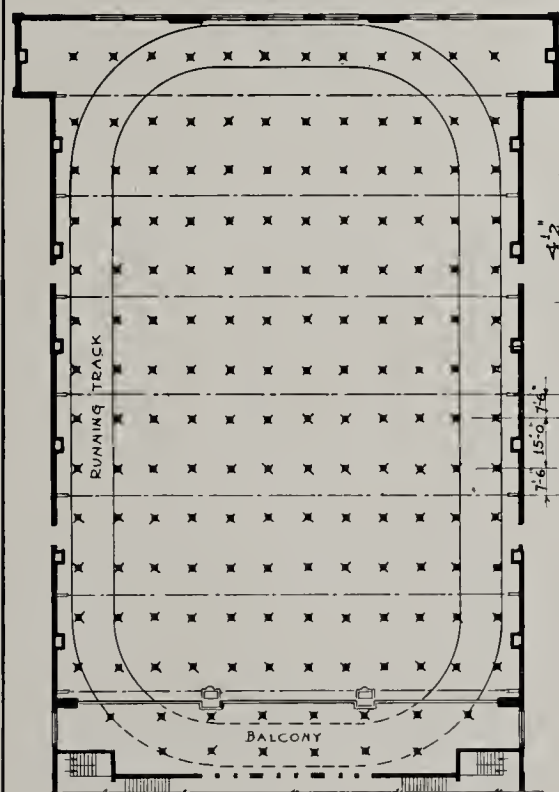
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X-Ray Reflectors For Large And High Buildings.



-ONE-HALF FRONT ELEVATION - $\frac{3}{64}$ " SCALE - ONE HALF SECTION THRU TRACK ROOM -

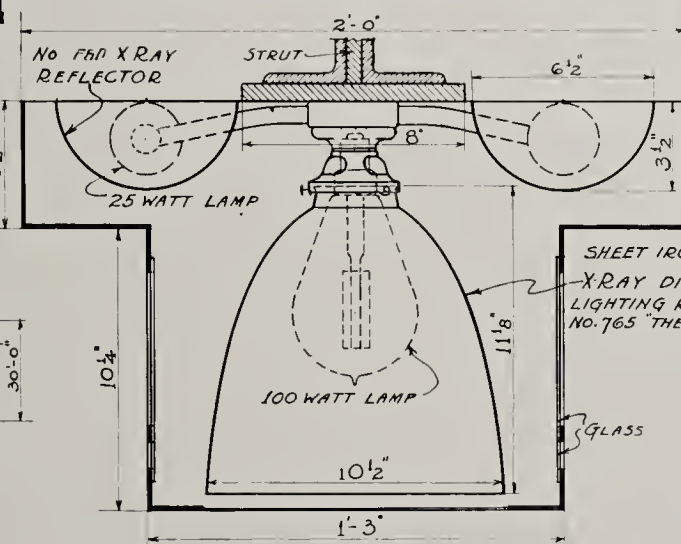


-PLAN OF TRACK ROOM
 $\frac{1}{64}$ " SCALE

THE LOCATION OF THE LIGHTING FIXTURES IS INDICATED.

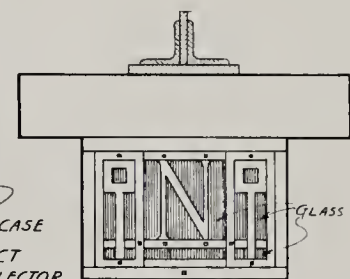
WATTAGE CONSUMED IS ABOUT .65 WATTS PER SQ FT FOR THE DIRECT LIGHTING. ADDITION OF INDIRECT LIGHTING FEATURE BRINGS TOTAL WATTAGE TO ABOUT 1 WATT PER SQ FT.

THIS LARGE ROOM FOR INDOOR SPORTS IS LIGHTED BY X-RAY BEEHIVE REFLECTORS WITH 100 WATT LAMPS. THE SAME LIGHTING ARRANGEMENTS CAN BE APPLIED TO ARMORIES, COLISEUMS, ERECTING SHOPS, ETC

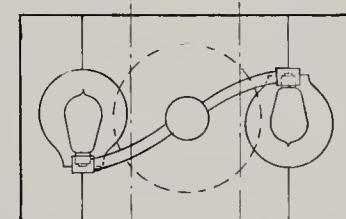


$\frac{1}{2}$ " SCALE SECTION

THE FIXTURE IS A BOX OF ART GLASS AND METAL WITH MONOGRAM ON SIDES. COARSE WIRE NETTING COVERS THE BOTTOM.



$\frac{3}{4}$ " SCALE ELEVATION



$\frac{3}{4}$ " SCALE PLAN

DETAILS OF LIGHTING FIXTURE

NORTHWESTERN
UNIVERSITY
GYMNASIUM

GEO. W. MAHER · ARCHITECT ·
CHICAGO · ILLINOIS



THE CEILING IS LIGHTED BY X-RAY REFLECTORS NO. 650 POINTED UPWARD. TWO 25 WATT LAMPS WITH THESE REFLECTORS ARE PLACED IN THE TOP OF EACH FIXTURE.

THE NATIONAL X-RAY REFLECTOR © CHICAGO ILL.

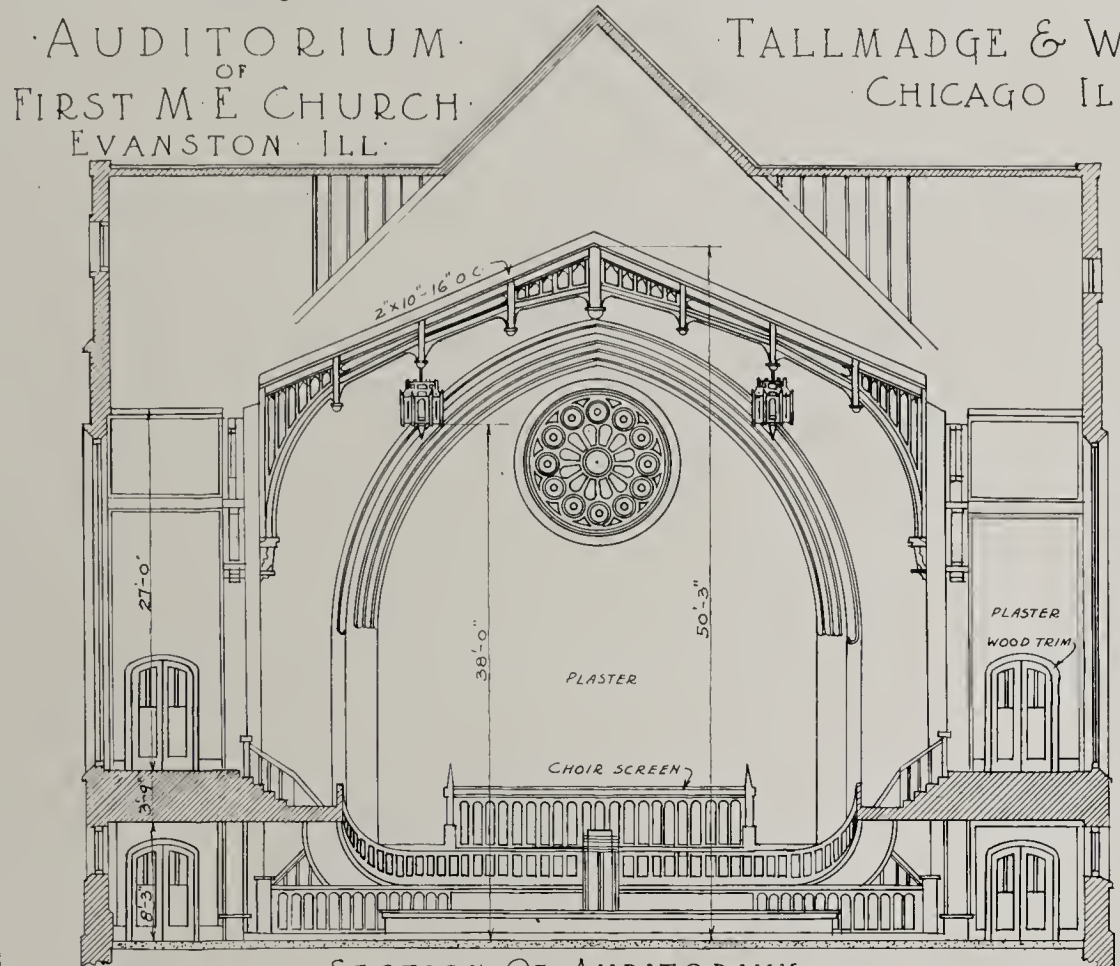
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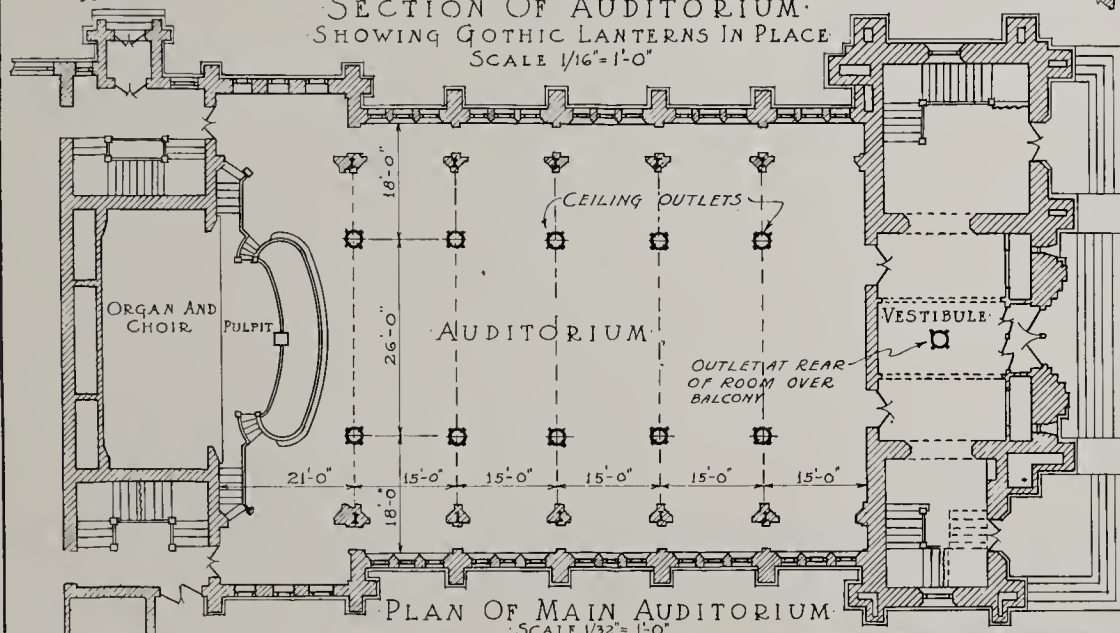
X-Ray Reflectors For Churches And Auditoriums WITH DARK CEILINGS

AUDITORIUM
OF
FIRST M.E. CHURCH
EVANSTON ILL.

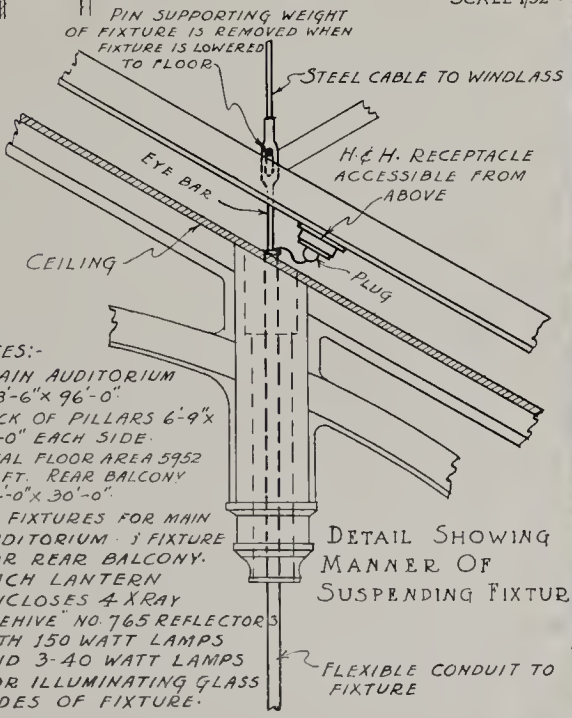
TALLMADGE & WATSON ARCHITECTS
CHICAGO ILL.



SECTION OF AUDITORIUM
SHOWING GOTHIC LANTERNS IN PLACE
SCALE 1/16"=1'-0"

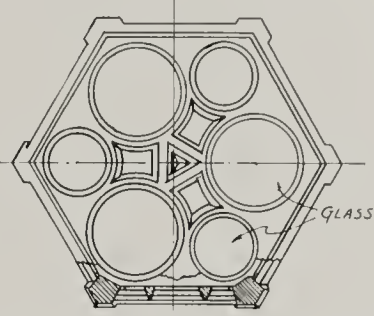


PLAN OF MAIN AUDITORIUM
SCALE 1/32"=1'-0"

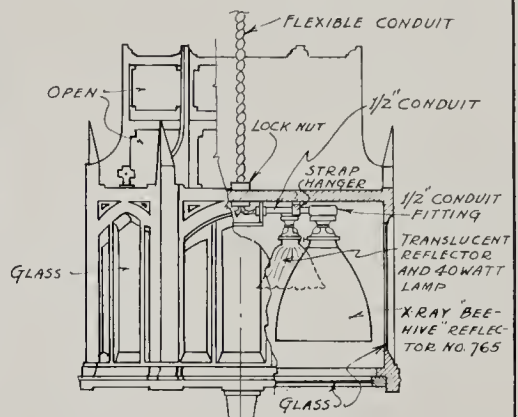


NOTES:-
MAIN AUDITORIUM
48'-6" x 96'-0"
BACK OF PILLARS 6'-9" x
96'-0" EACH SIDE
TOTAL FLOOR AREA 5952
SQ. FT. REAR BALCONY
24'-0" x 30'-0"
10 FIXTURES FOR MAIN
AUDITORIUM - 1 FIXTURE
FOR REAR BALCONY.
EACH LANTERN
ENCLOSES 4 XRAY
"BEEHIVE" NO. 765 REFLECTORS
WITH 150 WATT LAMPS
AND 3-40 WATT LAMPS
FOR ILLUMINATING GLASS
SIDES OF FIXTURE.

DETAIL SHOWING
MANNER OF
SUSPENDING FIXTURE
FLEXIBLE CONDUIT TO
FIXTURE

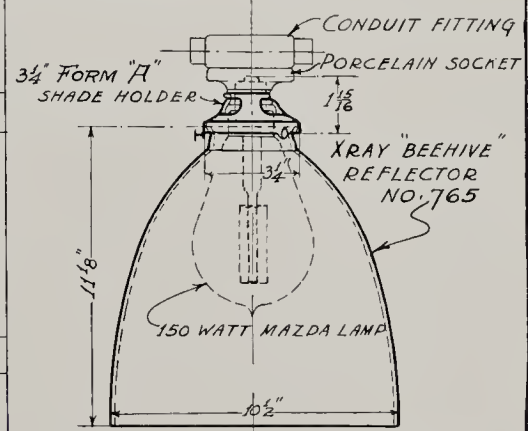


BOTTOM VIEW OF FIXTURE



DETAIL OF FIXTURE
SCALE 1/2"=1'-0"

A GOTHIC LANTERN OF OAK AND
ART GLASS. BOTTOM IS HINGED
AND MAY BE OPENED.



THE XRAY "BEEHIVE" REFLECTOR
SHOWING FITTING TO BE USED WITH IT.
SCALE 1/2"=1'-0"



THE NATIONAL X-RAY REFLECTOR CO. CHICAGO ILL.

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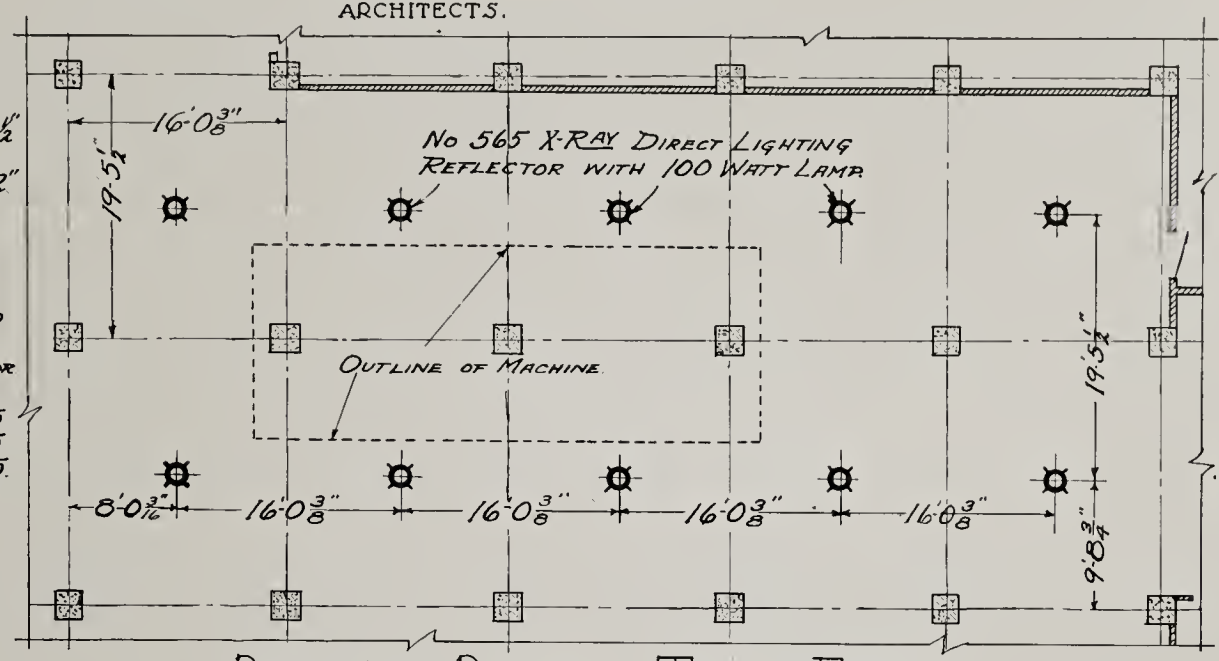
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X-Ray Reflectors For Manufacturing Bldgs

CALUMET BAKING POWDER CO. CHICAGO.
SCHMIDT GARDEN & MARTIN
ARCHITECTS.

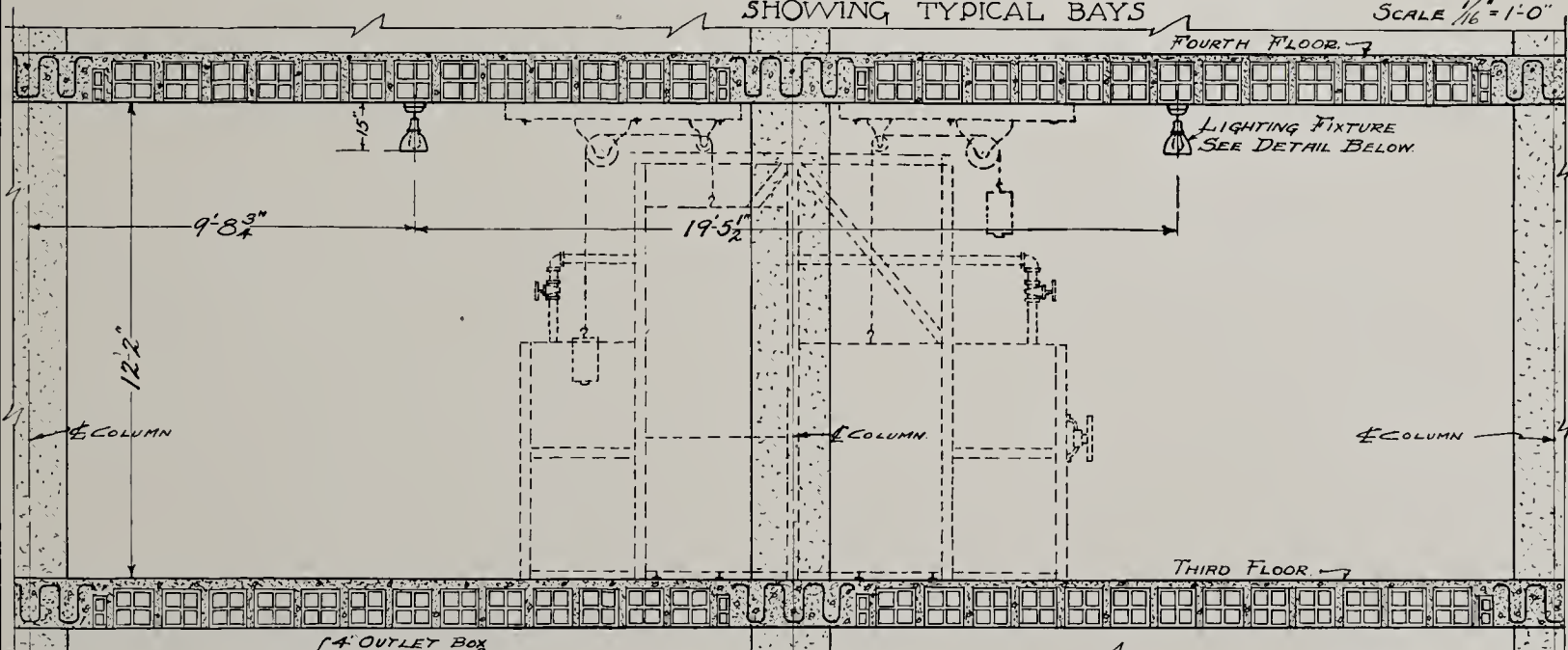
INSTALLATION DATA
SIZE OF BAYS - $16'-0\frac{3}{8}" \times 19'-5\frac{1}{2}"$
Sq Ft PER BAY - 312
CEILING HEIGHT - $12'-2"$
LAMPS - 100 WATT - ONE IN
CENTER OF EACH BAY.
WATTS PER SQ. FT. 0.32 FOR
GENERAL ILLUMINATION.
LIGHTING FIXTURES SUSPENDED
ON FLEXIBLE CORD 15 IN. FROM
CEILING TO BOTTOM OF REFLECTOR
REFLECTORS USED :-
ON FACTORY FLOORS - No. 565
IN PRINTING DEPT. - No. 765
IN TOILETS - No. 555.
OFFICES ARE LIGHTED BY
THE EYE COMFORT SYSTEM OF
INDIRECT ILLUMINATION.



PARTIAL PLAN — THIRD FLOOR

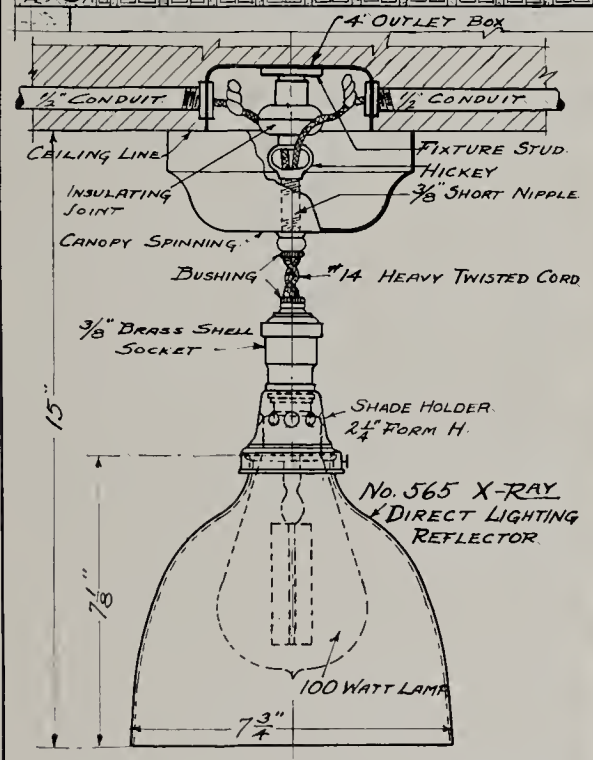
SHOWING TYPICAL BAYS

SCALE $\frac{1}{16}" = 1'-0"$



SECTION

SCALE $\frac{3}{16}" = 1'-0"$



DETAIL OF LIGHTING FIXTURE
SCALE $\frac{3}{16}" = 1"$



THE NATIONAL X-RAY REFLECTOR CO. CHICAGO ILL.

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This envelope contains twenty-four detail drawings giving complete illumination and installation data, on specific instances of the successful and economic lighting of buildings from concealed sources. We believe they cover the field, up to the present stage of development, excellently. From time to time we will send you additional plates, of a similar nature on new developments, and for this reason have made provision for another twenty-four in this envelope.

IT IS our endeavor to render valuable aid to you in the solution of your lighting problems. Therefore please bear in mind, that our staff of expert illuminating engineers, is ready and willing at all times to co-operate with you as fully as you desire, in solving lighting problems in the most effective manner.



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